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THE ELECTRIC VEHICLE.

WE have often pointed out the immense field for development offered by the electric automobile, and deplored the absence of any organised attempt to exploit it in this country, while referring with envy to the success achieved by our friends in the United States. This feeling is revived by a review of the past year's progress which appeared in the *Electrical World* of January 6th. Not only is the private electric vehicle widely adopted in the States, but also the commercial vehicle in even larger measure—a sure proof that it is not merely to the acknowledged convenience, reliability and ease of control of the electromobile that the popular appreciation of it is due, but to its economy compared with other types of automobile. We are told that the pleasure vehicle is now so common a feature in most of the larger cities that it no longer attracts attention; in Denver, for example, one person in every 200 owns an electric pleasure car, and electromobiles are met with in profusion in both the shopping and the residential quarters of the town. The commercial electric vehicles in use in the States, for every kind of service, number about 7,000, and represent an income to the electricity supply companies of about £600 a week. They are said to constitute probably one-third of the "motor trucks" in service in the United States, and if they increase in number at the present rate of expansion, in two years more they will contribute over £60,000 a year to the central stations for battery charging. Each of these commercial electromobiles consumes from 4,000 to 12,000 KW.-hours per annum, and the economical working of the vehicles is leading to their rapid multiplication. So highly is the electric "truck" appreciated by the railway and steamship companies, the police authorities and the insurance interests, owing to the improvement in the traffic conditions in narrow streets and on wharves and docks where it is used, that it is becoming a "privileged character" in the eyes of these people. The electromobile is also making its way into fire service, where its reliability, speed, and flexibility of control, are strong points in its favour. It is estimated that the tonnage of street haulage is no less than 16 times that of train haulage, and that if none but electric "trucks" were used in Greater New York, the present central-station load would be increased 12 times.

In view of these vast possibilities and the successes already achieved, a determined propaganda has been organised to develop electric-vehicle transportation in the Eastern States, various Associations and companies co-operating for the purpose. Over £200,000 worth of electric vehicles are now in course of construction, and a great advance is confidently anticipated during the current year.

In the meantime, what are *we* doing? Nothing! The history of public electric vehicle enterprise in this country has been one continuous record of disappointment and failure; the field has been infested with company promoters and financial jugglers, who care nought for

the industry and seek only to enrich themselves at the cost of a too-confiding public, which pays no heed to the warnings of the technical Press, and therefore pays the penalty of its rashness. Not all, it is true, have been enterprises of this class; honest ventures there have been, and are, but they have lacked support, as is too often the fate of genuine industrial enterprise in this country, where capital is always ready to finance a wild-cat scheme. But almost all have shared the same sad fate. Yet there is no fundamental reason why electric road vehicles should fail here, while they are successful in America. It certainly is not the cost of energy—nowhere in the world, on the whole, is electrical energy so cheaply available as in this country. Our lead storage batteries are as good as any made elsewhere, our cars are unexcelled. In one important respect the American procedure has differed from ours; there, it appears, private concerns have been induced to adopt the electric vehicle, while here public transport service and the hiring system have mainly absorbed the attention of those interested in this business.

Is there not here a magnificent opportunity for some person or society to develop what would be a practically new field for the electrical trades? Suppose, for example, one or more of the great carriers were induced to adopt electric parcel delivery vans, under a guarantee, for a stated period—the vehicles being returned daily to a garage for inspection and charging. Excellent terms for energy should be readily obtainable from almost any of the Metropolitan supply authorities for a load which would never come on the peak, and which, for example, would be a godsend to companies supplying a West-End residential district where a power load does not exist.

There are strong grounds for believing that if such a trial were made on an adequate scale, under expert supervision, it would prove a success, and would be an object lesson which other carrying companies could not fail to take to heart. What is wanted is proper business organisation and co-operation for the purpose. The supply authorities themselves should be the first to back up such a scheme—but somehow there is a pitiful lack of energy and enterprise among our central-station managers, with rare but honourable exceptions. Why don't they wake up and *create* a demand for their commodity?

A Dead Letter.

In view of the proposed activities of the prospective Association of Consulting Engineers, it may not be without interest to consider for a moment the procedure of the parent Institutions with regard to professional etiquette. The Civil Engineers, for example, not very long ago codified the laws of professional good form, and the Electrical Engineers propose to adopt the same code practically *verbatim*. But the rules have been recognised in principle for many years, and the mere casting of them into the shape of a formal code did not create them. Will it lead to their enforcement?

Is there any case on record where either Institution has ever taken drastic steps to deal with the notorious infractions of the rules which have been committed in the broad light of day? We know of none. We have before us as we write a blatant example of breach of professional etiquette; it is a leaflet issued by an insurance company, which bears the name of the chief engineer of the company in bold type, followed by a string of letters which include those indicating his connection with the Institution of Civil Engineers, together with the name of a colleague claiming membership of both the Institutions above named. The leaflet offers plans and specifications, and advice as to the improvement of existing plant and the laying out of new plant; reference is made to the "consulting work" of the company, which appears to embrace practically all branches of steam and electrical engineering—in a word, it is a barefaced advertisement inviting the appointment of the *company* as consulting engineers.

Has either Institution lifted a finger to put a stop to this practice, or to expel the engineers named on the circular from membership, as laid down by the code? If so, we have yet to hear of it. Other insurance companies advertise their staffs as consulting engineers in similar fashion. A more flagrant breach of the letter and spirit of the code it would be difficult to find—but nothing is done.

Not only is this advertising by circular freely carried on without interference from above, but the companies' agents act as touts and canvass for consulting work; we have been informed that they even have the hardihood to depreciate the work of consulting engineers whose clients' plant they insure, with a view to securing the work of advising on extensions. Moreover, the companies are not above accepting fees on a scale that can only be regarded (by consulting engineers) as blacklegs' pay—of the order of 2 per cent.

It cannot be contended that the Institutions have not been aware of these doings; not only have they been notorious, but the facts have actually been brought to their notice. But nothing is done. Can it be that the members of the Councils are debating which shall cast the first stone at the offenders? Or are they afraid?

Electric Railway Working in Germany.

It is now just over a year since experimental working with the single-phase system was introduced on the main line between Bitterfeld and Dessau, and the results are declared to have been extremely satisfactory. So much so that the Prussian State Railway authorities, as already reported, have decided to proceed with the electrical equipment of the section between Halle, Leipzig, and Magdeburg, which has a total length of 97 miles, and the extension of the power station at Muldenstein is now being carried out. According to Prof. J. Kollmann, of Dresden, the working conductor on the Bitterfeld-Dessau section, which was provided in equal halves by the Siemens-Schuckert Works and the A.E.G. respectively, has fully answered the purpose during the year, and has not even found sufficient employment for the workmen specially appointed to attend to its maintenance. The working conductor is supplied with single-phase current at 10,000 volts and 15 periods. Single-phase current is produced in the power station at 3,000 volts, and is transformed up to 60,000 volts, and transmitted to the sub-station near Bitterfeld, where it is stepped down to 10,000 volts for feeding into the line. It has been ascertained that about 80 per cent. of the total return current goes back through the rails. As soon as the Halle-Leipzig-Magdeburg section has been completed, it is intended to increase the pressure on the working conductor to 15,000 volts. During the past year eight different types of locomotives have been employed on the Bitterfeld-Dessau section, these including not only locomotives specially ordered for the line, but also some which have been built by the Siemens-Schuckert Works and the A.E.G. for non-Prussian railways; and locomotives intended for the Berlin City and Circle Railways are also to be tested on the section in the near future. Eighteen locomotives have been constructed, or are in course of building, for the railway, and 40 others are to be shortly thrown open to competition, and are intended for the extension to the hilly line of Lauban-Dittersbach-Konigszelt. Shortly before the close of 1911 a new type of locomotive was delivered by the Bergmann Electricity Works Co., having driving wheels of 1·6 m. and running wheels of 1 m. diameter, and a maximum speed of 86 miles an hour. The weight is 66 tons, of which 26 tons are due to the electrical equipment, whilst the other high-speed locomotives have a weight of about 70 tons. A goods locomotive has been furnished by the Schwartzkopff-Maffei Works, of Berlin, and a locomotive has also been supplied by Brown-Boveri, of Mannheim. Prof. Kollmann adds that the single-phase system has achieved an undoubted success for main-line working, and he expects it to result in economy in operating expenses

and more punctual service than is the case with steam railways. It is believed that the Halle-Leipzig-Magdeburg section, which is practically a level track, will be opened for traffic by the end of this year.

The Rating of Machinery.

IT is fashionable among men of business to say that the law is uncertain; that rather than submit to legal decision, it is better to pay up and have done with it. Among the legal questions which thus puzzle the commercial world, there is none more prominent than those which arise out of the phrase "rating of machinery." Is machinery rateable? If so, upon what basis? These questions were recently considered in a case heard by the Recorder of Leeds. The owner of a generating station, factory, or mill, knows, to his cost, that there are two ways in which his rates may be increased. Either the district rate may be raised—a matter over which he has no control—or his rateable value may be increased, a matter in respect of which he may appeal from the Assessment Committee to the Court of Quarter Sessions. It is upon such appeals that legal questions are generally discussed, although, of course, they may be taken to a higher Court. In recent years certain manufacturers have made a gallant attempt to persuade the Courts that loose machinery is not rateable, that is to say, that the machinery should not be taken into account in order to enhance the value of the premises. The House of Lords, however, has finally decided that, in accordance with the practice of the last 50 years, machinery may be taken into account, but upon no fixed principle. The rating authority, apparently, must make an estimate of the amount by which the value of premises would be enhanced to a prospective tenant.

In the case in question, Messrs. Greenwood & Batley, of Leeds, appealed against a rateable value of £6,050, which had been imposed upon their works by the Guardians of the Bramley Union. It was alleged that the valuer, in order to bring the machinery on the premises into rating, had put 5 per cent. on machinery valued at £49,000. It was contended that this was a wrong principle on which to fix a rate, and that due regard had not been had to the nature of the premises themselves. The mere value of the machinery could not be relied on, inasmuch as a machine which was valuable in one building might be unworkable in another. It was pointed out, in this connection, that the works in question were extremely inconvenient. There were a large number of processes carried on, and owing to the fact that the works had grown up piecemeal, they were badly arranged. It was also shown that in consequence of high rates on machinery, many firms had left Leeds during the last few years. The Recorder of Leeds was apparently impressed by these arguments, for he reduced the rateable value to £4,872, and allowed the appeal with costs. No general principle was enunciated by him—indeed, none could be; but owners of electrical and other machinery should bear in mind that when they see cause to quarrel with a rate it is quite legitimate and proper to draw attention to the inconvenience of their premises for the purpose for which they are used.

London's Congested Streets.

DISCUSSION is again becoming prominent on the congested state of the streets of London. It would almost seem that, to many, this state of congestion has only just made itself visible. It is not long since a Commission sat upon the subject, and brought forth a very strenuous proposition, so strenuous, indeed, that it was promptly shelved as being too costly. This proposition was for a great thoroughfare to be driven boldly through huge areas of property at a cost, if we rightly remember, of about 30 million pounds sterling. Some critics considered not only that the scheme was extravagant, but that it would not deal with the difficulty. It was pointed out that the congestion arose almost entirely from the vehicular interference at right-angled crossings, and it was urged that all the congested crossings should be enlarged to form circuses of considerable diameter, round which traffic would circulate clockwise. Simple as is this proposition, no attempt has ever been made even to test its feasibility. The circus system is equally applicable to tramways and to ordinary vehicles. Yet, though the suggestion was public at the time of the construction of the L.C.C. tramways, that complicated system of tramway "special work" at the Elephant and Castle was put in hand without an attempt to simplify it, even by a partial adoption of the circus system. From time to time proposals have been put forward for the construction of shallow subways to relieve the surface traffic, but the cost of the work, as exemplified by the subways at the Bank, Blackfriars, and the Elephant and Castle, would be enormous. Nobody will ordinarily use a tube for a short journey, for too much time is consumed in the lifts and in waiting for trains down below, and in those breezy walks up hill and down dale, which appear to be so necessary a part of the design of the tubes. The New York subway certainly stands first in the solution of rapid transit. Yet even shallow subways are inferior to surface automobiles in many respects, and the resources of the surface are not exhausted, for the surface has never yet been placed in a position adequately to deal with traffic; nor can it so be placed to deal with it, unless the traffic intersections are taken in hand and dealt with on the lines of the rotatory whirlpool, into and out of which any vehicle can so easily turn. Meantime, the streets are made the roadway for tramcars, 'buses, taxis, and every manner of vehicle, and little is being done to relieve the congestion of traffic.

Director and General Manager.

THE large majority of the great firms who share the best of the business in electrical matters, are limited companies. Fundamentally, the executive of every such concern comprises a board of directors with a general manager responsible to it. Given a weak body of directors and a sufficiently strong general manager, it is obvious that he can steer the ship very much as he chooses. But given a strong director, or a director who is of an inquiring turn of mind, what power can he exercise over the general manager? What can he say to him without running the risk of an action for libel or slander? That some power and some control should be exercised is manifest, having regard to the fact that responsibility rests with the directors if anything goes wrong. In a recent case in the King's Bench, the exact position and rights of a director in this regard were clearly explained. The facts were very brief. The general manager of an insurance company made a statement to his board which one member of that board characterised as a deliberate falsehood. The manager brought an action against him for slander, to which the plea of privilege was raised. The defendant alleged, in effect, that the words were uttered by him without malice and in the honest discharge of his duty as a director. A City of London jury found as a fact that, although the accusation was false, there was no malice on the part of the defendant. He, accordingly, obtained the verdict. Mr. Justice Scrutton had said, in the course of his summing up: "Directors of a company have a duty to discuss the affairs of their company, and may discuss the conduct of the company's officials, so long as they do so honestly. If so, they are privileged. If, however, a director does not use, but abuses the occasion by showing malice or spite, the privilege is gone. . . . . The position of a director cannot be said to be a happy one. If there is a general manager, and the directors leave everything to him, it is said when things go wrong: 'You left everything to the manager; you did not do your duty as directors.' If, on the other hand, the directors hold their own views, it is sometimes said they are interfering with the general manager." This case arose because the general manager thought himself slandered; although it does not appear that if he had not divulged the matter, anyone outside the board-room need ever have known that the words were spoken. The lesson of the case for the general manager is that it is no use being too thin-skinned.

ELECTRIC POWER FOR THE PANAMA CANAL.—II.

By JOHN GEO. LEIGH.

As already suggested, one of the most conspicuous functions of the new power station in Gatun spillway will be to furnish current to the many hundred electric motors which are to be installed at the various locks. Of these a large majority will be employed in connection with the gate-moving and other operating machinery of the Canal, and with the elaborate system of culverts and valves by which the lock chambers will be filled and unwatered.

Consequent upon the unprecedented dimensions of the locks, all the adjuncts of the latter are necessarily of unusual size, strength and capacity; and this, of course, entails corresponding features in the design of the electrical equipment. To appreciate the importance of the work imposed upon the latter—the aggregate weight of which will exceed 7,000 tons—some indication of the various machines with which it will be associated is obviously desirable, and even essential. This it will be my endeavour to furnish in as few words as possible, and with little reference to details appertaining more closely to the interests of the mechanical than the electrical engineer.

For the design, construction, inspection during manufacture, and erection of this machinery, prime responsibility falls upon what is called the first division of the office of the chief engineer. This is in charge of Col. H. F. Hodges, Corps of Engineers, U.S.A., who, prior to his appointment to membership of the Canal Commission and the positions of deputy-chairman and assistant chief engineer, acted for several years as chief purchasing officer and head of the Canal organisation in the United States—an experience which has proved of great value to the Commission (but possibly not altogether to the liking of many American manufacturers) in connection with the distribution of important contracts. In the purely technical departments of his division, Col. Hodges has enjoyed the advantage of the assistance of an exceptionally capable staff, prominent among whom must be mentioned Mr. Edward Schildhauer, mechanical and electrical engineer, to whom has been committed direct charge of all matters, including inspection and erection, connected with the operating machinery and electrical installations.

To open and close the 46 mitring mates of two leaves each with which the locks are being provided, special machinery has been invented by Mr. Schildhauer, and a patent has been issued upon it. Each leaf, it may be well to recall to mind, is 65 ft. in length; 48 are 77 ft. high, and the height of the remainder varies—according to the distance from the top of the coping on the lock wall to the top of the sill on the concrete floor of the lock chamber—from 47 ft. 4 in. to 82 ft. The weight of each leaf depends upon its height—for all the gates are practically identical in design and construction—and, so far as revolving parts only are concerned, varies from 275 to 450 tons. One gate-moving machine, with individual electrical equipment, will be required for each leaf.

Fig. 5 is a photograph of Gatun locks, looking south, showing the west chamber of the middle lock, with the upper lock and upper guard gates in the distance; while fig. 6, also a photograph from Gatun, illustrates the method of construction of an upper guard gate, and, indeed, of all the lock gates. On the left of the picture is shown the spacing of the internal girders, while the leaf on the right is partially completed, so far as its steel sheathing is concerned.

The essential features of the Schildhauer machine are, first, a "bull wheel," 19 ft. 2 in. in diameter, a combination gear and crank, constructed of cast-steel, and weighing approximately 35,000 lb., which is mounted in a horizontal position on the lock wall, turns on a large centre pin, has gear teeth on its rim, and is driven by a single pinion on a vertical shaft; and, secondly, a steel rod, or strut, connecting the wheel with the top of a gate leaf. When moved through an arc of 197°, the wheel, operating through its strut, opens or shuts in about two minutes—according to the direction in which it is turned—the gate leaf to which it attached. The vertical shaft associated with it is driven by a bevel gear and pinion, the latter being fast on a horizontal shaft which passes through a bulkhead separating the motor and wheel chambers, and carries a gear with spring centre, driven by a pinion on the back shaft of the motor.

A second machine required in the operation of the gates is designed to force the latter to perfect mitre and lock them in that position when they are closed. It consists essentially of two box-shaped castings, one bolted to the outer case of the top girder of each gate leaf. Of these castings, one carries a pair of movable jaws and their operating mechanism, and the other a large pin which is enclosed by the jaws when the gate leaves are brought together. A prominent feature of the mechanism is a screw, turned by a bevel gear in mesh with a bevel pinion on the motor-driving shaft, which passes through a plug bearing and is connected to the motor shaft by means of a friction cut-off coupling. The motor is provided with a solenoid brake, by which the machine can be brought to rest instantaneously when the current is shut off by the limit switch. It is estimated that the time required for the completion of the operations for which this mechanism has been devised is but 15 seconds. In this case, of course, only one machine and installation of auxiliary electrical equipment are required for each gate, or pair of leaves.

Ten tenders, ranging from $652,000 to $862,000, were submitted for the supply of gate-moving machines, and 12, varying from $41,200 to $71,500, for that of mitre-forcing machines, each without electrical equipment; and in each case an award was made to the lowest bidder for a sample trial machine. For trial motors, orders have been placed, after long delay, with the Allis-Chalmers and General Electric Companies. To the tests to which these and other motors supplied to the Canal Commission have been and are yet to be subjected, I propose to refer at some length in a later portion of these articles.

For the purpose of checking the flow of water through the locks in the event of damage to the gates, or of repair or other work in the lock chambers necessitating the shutting off of water from Gatun Lake level, six so-called emergency dams are being built. These will be placed in the approaches to the upper twin locks of each flight, about 200 ft. above the upper lock gates. The total amount of metal required in their construction is estimated at 12,000 tons, and the value of the contract which has been placed for their supply and that of the machinery to operate them is about £461,100. Each dam is constructed on a steel bridge of the cantilever type, of which the long arm, intended to extend over the lock chamber and hold the dam, is 163 ft. long, and the short arm about 98 ft., the extreme width being 93 ft. The bridge will be pivoted on the side wall of the lock approach, and when not in use will rest parallel to the channel, but, when required, will be swung across the latter, with the long arm resting on the middle wall. A series of six girders, hinged to the bridge, will first be lowered into the channel, their ends resting in iron pockets embedded in the masonry floor, and then six panels, or gates, moving in the girders on roller bearings, will be dropped by gravity until they form a horizontal tier spanning the lock approach, and damming the water to a height of 10 ft. Successive rows of six panels will subsequently be lowered until a complete closure of the channel is effected from the bottom upwards. At the Gatun and Pedro Miguel locks, the dams will be provided with five series of panels, but at Miraflores, consequent upon the lesser depth of water, only four rows are required.

Three classes of machinery, all to be controlled from an operator's house erected at the end of the short arm of the cantilever bridge, are needed for the working of these dams—(1) for turning the bridge; (2) for lowering and raising the wicket girders; and (3) for hoisting the panels, or gates. The first will consist of two motors for turning each bridge, a limit switch preventing operation beyond an arc of 90°, and a motor for driving the steel wedges which will hold the bridge firmly in place across the channel or when at rest on the lock wall. The machinery for operating each of the wicket girders includes two hoisting units and a motor unit, all gearing driven from the latter being contained in oil-tight cases affording complete protection from the weather. The motor is started by turning the handle of the controller

to the lowering position, and a solenoid at the same time draws a jaw clutch on the motor shaft into mesh with the high-speed gearing, the girder being dropped to the lock-approach floor in about four minutes at a quite uniform rate of speed. When there exists necessity to raise a girder against the current, to allow an obstruction to be washed out of the floor seat, or for other reason, the controller handle is brought back to the hoisting position, whereupon the clutch is engaged

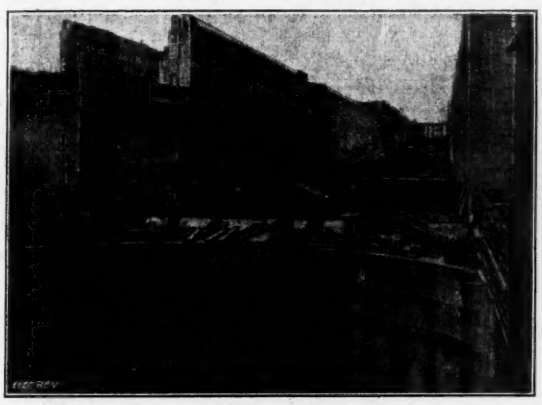


Fig. 5.—Gatun Locks, looking South.

with the slow-speed raising gear, permitting a return of the girder to its original position in about 18 minutes. Movement in either direction is stopped at the proper time by means of a limit switch. The machine to be employed in hoisting the several gates required to close the openings between the wicket girders consists of a system of hoisting drums, loose on a common drum shaft, which is motor driven through spur gears and a worm and worm gear, the last-mentioned being self-locking and capable of holding a gate in any position when the motor is stopped.

From the foregoing it will be seen that for the operation of the six emergency dams there will be required 12 motors for driving the machines employed to turn the bridges, with six limit switches and six motors for driving the wedges; 36 wicket girder machines, provided with 36 motors and an equivalent number of limit switches; and 36 gate-hoisting machines, each driven by its individual motor.

The next appliances connected with the locks to which attention must be directed are the chain fenders, 28 in number, which are to be placed at various points in the three lock flights. Properly speaking, these should not be included among the lock-operating machinery, but rather under the head of protective devices, for their purpose is to prevent from being rammed the gates above or below which they are placed, by forming a barrier to the further progress of any ship approaching a lock under its own power, or which may have escaped from the control of its escort of electric towing locomotives. A fender chain, therefore, will always be in service, that is, stretched across a lock chamber or approach from the tops of the opposing walls, except when it is desired that a ship shall pass; it will then be lowered into a groove provided for the purpose in the lock floor, the operation of lowering or raising being performed from both sides by mechanism installed in the lock walls.

During the past three years or more, extended studies have been made by the Canal Commission with a view to arriving at a more satisfactory design than prevails at English docks in respect of the method of producing resistance to the paying-out of such chains. Attention has been directed mainly to three forms of resistance—the raising of heavy weights, the friction of metallic surfaces, and the flow of a fluid through small orifices; and in all the designs studied, except where a fluid resistance was used (the chain in such cases being raised and lowered by hydraulic machinery), winding machines driven by electric motors were adopted. The result of the studies thus far must be regarded as provisional, it having been decided to test in place a sample hydraulic machine, and, pending the issue of this trial, to hold in abeyance the definite adoption of any particular system. As at present arranged, therefore, the fender chain mechanism will consist in the main of a system of hydraulic cylinders, operated by a centrifugal pump connected to a motor, and of the necessary sheaves, bearings and connections for attaching and supporting the chains. Should this apparatus prove unsatisfactory, there is little doubt that frictional resistances, with increased electrical equipment, will be substituted.

The incident, or conflict, if such it can be called, is certainly of more than local and passing interest, for—throughout the 50-miles-long Panama Canal—in connection only with these fender chains has hydraulic power been able to withstand the superior and ever-encroaching claims of electrical power. This triumph of electricity is especially noteworthy, first, because canals and docks have been regarded heretofore as the most appropriate and peculiar fields for the application of hydraulic power, and secondly, because the abnormal humidity of the Central American isthmus constitutes a strongly inimical factor against the installation of comparatively delicate and susceptible apparatus.

An interesting and, from some points of view, instructive story has to be told in connection with the supply of the machines and electrical equipment required for the operation of the 240 rising stem and cylindrical valves forming part of the culvert system for filling and unwatering the various lock chambers. The first circular inviting proposals for furnishing and erecting certain portions of this machinery was issued in July, 1910, and resulted in the receipt of seven tenders, all of which were regarded as excessive, and, for that reason, eventually rejected. The work was then re-advertised, with modified specifications, embodying one change in design and some minor variations as regards material; and special efforts were made to attract to the contract the attention of foreign manufacturers. Whatever its causes, there can be no question of the reality of the transformation effected by this action of the Canal Commission, duly authorised by the President. February 25th, 1911, was announced as the date on which tenders would be opened, and it was then found that there had been received 11 offers for the supply of rising-stem valve machines, 15 for the cylindrical valve machines, four for the motors required for each class of machine, and seven for the limit switches. Even more suggestive proved a comparison of the prices quoted in response to the two circulars. The total consideration of the contracts placed last year, and of those which remain to be awarded after satisfactory trials of the sample machines ordered, will amount to about £186,600. Had, however, the same quantity of material been purchased

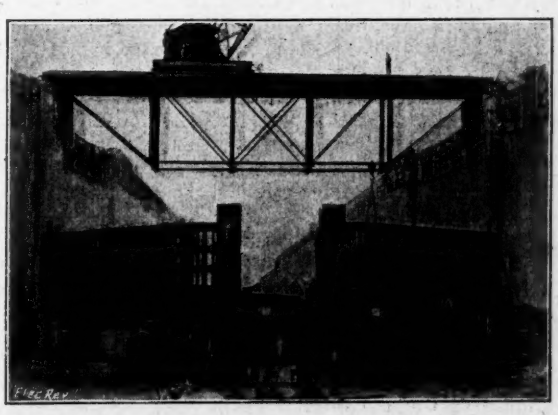


Fig. 6.—Building up an Upper Guard Gate, Gatun Locks.

in 1910 on the basis of the tenders then received, the Government and people of the United States would have been mulcted in an additional sum of over £100,000.

For both types of valve-operating machines the Wheeling Mold and Foundry Co. submitted the lowest tenders, and, accordingly, with this firm were placed orders for four sample sets of mechanism, exclusive of electrical equipment. It appears that one reason why these West Virginian manufacturers were enabled to underbid their competitors was that they offered for the valve stems Mannesmann steel tubing,

D

made in Germany, at a price clearly proving that such tubes, free of duty, cost less than one-half the sum demanded for similar American-made material. The first two completed machines were tested in September and October at Wheeling, under the direction of a representative of the Canal Commission, and subsequently in place at Gatun locks. They were operated with

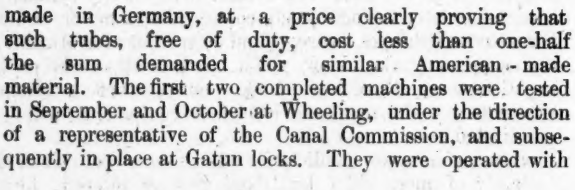


FIG. 7.—STONEY GATE VALVE-FRAMES IN POSITION, EAST SIDE WALL, UPPER LOCKS, MIRAFLORES.

four different motors and limit switches, in each instance satisfactorily and in accordance with the specifications; and, as a result, the conditional contracts with the makers have been extended to cover all plant of similar type required. As regards the electrical equipment, definite awards are yet in abeyance, pending the completion of the exhaustive trials to which the sample motors supplied are being subjected. The lowest tenders received in February, 1911, for motors for each class of valve-operating machinery, and also for limit switches, were submitted by the General Electric Co. of Sweden. They compared favourably, even with duty added, with any offer made by an American concern, but, after consideration, were ruled *hors concours*, owing to certain informalities and to the fact that they were not received until some weeks after the time fixed for the opening of tenders. That there existed a strong feeling on the part of the Canal authorities in favour of the offers from Vesteras is evidenced by the fact that, in the first instance, and despite the informalities referred to, conditional awards were made to the Swedish company. They were, however, withdrawn later, in deference to a semi-legal ruling to the effect that, under the circumstances, the tenders could not properly be accepted. Orders for sample motors were consequently placed with the Allis-Chalmers, Westinghouse Electric and Manufacturing, and General Electric Companies, at prices, per motor, ranging between $710 and $567, in the case of the rising-stem valve machines, and $350 and $277, in that of the cylindrical valve machines. Awards were also made to the two last-mentioned firms and the Cutler-Hammer Manufacturing Co. for two limit switches for each class of machine, at an average price of about $55.

In my next article will be included descriptions of the two classes of culvert valves, their duties, and the manner in which they will be electrically operated; of the special requirements of the Commission in respect of the electric motors to be installed in the locks, and the severe tests to which this plant is being subjected; and of the electric towing locomotives to be used in the navigation of the locks. In the meantime, attention may be directed to fig. 7, as indicating in some degree the massive proportions of the lock culvert system and its equipment.

Canada.—H.M. Trade Commissioner reports that a company has been formed, with a capital stock of $500,000 (about £103,000), to manufacture bare and insulated and underground, aerial and submarine cables. The names of the companies may be obtained by British manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Transformer Design.

May I, for the benefit of other unwary ones like myself, refer to what I conceive to be an error in that, in many ways, estimable book by Dr. Hay on "Alternating Currents." In describing the Scott method of phase transformation, Dr. Hay states on page 134, 1911 edition, that the primary of the one transformer "has $\sqrt{3}$ times the number of turns in the primary of the other transformer."

I recently had occasion to wind a pair of transformers for the above purpose, and, in an unguarded moment, took my figures direct from the book without checking them, with the result that I now have the privilege of working all night to set matters right. The ratio, of course, should be $\frac{2}{\sqrt{3}}$ times.

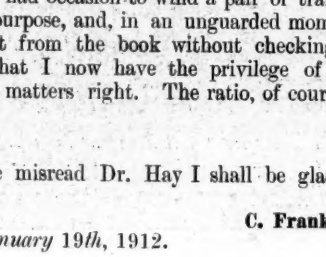
If I have misread Dr. Hay I shall be glad to have it pointed out.

C. Franklin Tubbs.

Leeds, *January 19th*, 1912.

Earthed Concentric System.

Can you inform me why it is considered by some engineers bad practice on earthed concentric systems of house wiring



to feed the light with the inner conductor, with the switch across inner and outer, as sketch attached?

Earthed Outer.

[The point is covered by Rule 65 of the I.E.E. Wiring Rules, 1911:—"All consuming devices must be controlled . . . only on the internal conductor." "No switches . . . may be placed in the external conductor." The spirit of the Rules, however, is not broken by the arrangement illustrated, for the continuity of the outer conductor is never interrupted, and all live conductors are continuously surrounded by the earthed outer.

To be in strict accordance with the letter of the Rules, the switch wire must be taken off at A, and must be run double to the switch, the outer conductors in this case being idle. We see no real objection to the connection shown, except that it does not conform with the Rules.—EDS. E.R.]

Capital and Labour.

In reply to "A Working Electrician," I may say I am not a Trade Union leader, and perchance have to work as a wireman equally as hard as any other conscientious worker. 'Tis the first time that I have seen it stated that men outside a Trade Union have a monopoly in that respect.

Really I don't quite know how to answer my friend. The mere fact of dock labourers and miners getting better wages in a great number of cases than draughtsmen, engineers, &c., get, is because the so-called unskilled men belong to strong Trade Unions, and the others do not. He wants to know how Trade Unions do good. Take our own trade, for instance. For the sake of argument, let us say that a working electrician, boiled down, is a wireman. Let us also suppose that he lives in London, and gets the standard rate of 9½d. per hour. *For that rate he has to thank the Electrical Trades Union*, and I think that any fair man will admit the truth of this statement. If there had been no branches of our Union in London the rate would be what it is in other towns where no branch of the Union exists, viz., anything up

to 7d. an hour. This rate of 9½d. was not got by a strike, but by agreement.

Possibly our friend gets more than the standard rate, as heaps of men who are above the average do, but the amount over the rate always has, as its base, the standard rate of the district. Heaps of men have conscientious objections to joining a Trade Union, but never yet have I met a man conscientious enough to refuse any increase that has been gained through the action of Trade Unions. I may say the Electrical Trades Union has no politics. We don't ask any man whether he is a Tory, Radical, Socialist, or what not; we are out to try and get fair treatment from our employers, and the first object, quoting our organising leaflet, is: "To provide employers with competent men in the various branches of the trade." That, I take it, is why our membership is increasing so rapidly all over the country, but more especially in London. We are up against scamped work and underpaid labour, and if the employers could only see it, we are their best friends.

A firm that is fair has no chance to compete in the open market with firms that pay low wages to their workmen. The latter, we, as a Union, are out to fight, and I think even our "C. W." friend would admit (if he could know what work in that direction we are doing) that we are doing some good for the trade, at which we both have to earn a living.

W. J. Webb,
Electrical Trades Union.

London, W., *January 20th*, 1912.

I shall be glad if you will allow me to express my concurrence in the remarks on this subject made in your last issue by "A Conscientious Worker."

There is no doubt that England's trade—as he infers—has suffered badly through the growth of Trade Unionism, and it must be cheering to all struggling employers to find that at least one worker is not afraid to support our case against the Unions.

The most vital factor in our prime costs is labour; and, in order to keep ahead of our competitors, we must have cheap labour, which (as "A Conscientious Worker" shows) the Unions are doing their best to kill.

It is scandalous that the Unions should be allowed to fix such a high standard of wages for the comparatively unskilled worker, while really efficient men can be obtained for such branches of the electrical profession as draughtsmen, engineers, station attendants, &c.—where the workers are too highly educated to suffer any interference from Trade Unions—at wages from 10s. to 30s. a week.

As your correspondent truly remarks, "It is impossible to go on increasing the unskilled wages . . . without making the skilled man's lot harder."

Until Trade Unions are abolished we can never hope to keep down our labour costs to their proper level, and I hope that all aristocrats of labour will follow the example of "A Conscientious Worker," and concentrate their attention on the abolition of Trade Unionism, so that we can compete more successfully in the world's markets.

Capitalist.

Arc Lamp Lowering Gear.

I have read with interest your description of the arc lamp lowering and traversing gear, as illustrated in the ELECTRICAL REVIEW, January 19th. There are disadvantages, however, in following the method described, of drawing the lamp and contact gear to the side of the road before lowering. The disadvantage is generally experienced when the second contact is introduced. This contact is a horizontal one, and by no means rigid, so that in a high wind there is a probability of arcing. Several manufacturers are supplying contact gear which dispenses with the side contact, thus reducing the first cost and cutting out an unnecessary complication.

Another disadvantage is the fact that the vertical contact traverses the span wire; this means that the cable is not permanently in position, and when the lamp is drawn to the side of the road, the cable hangs in a loop or loops. When this cable has been in use for some time, particularly in an atmosphere like that of London, it will be found that the braiding will crack, and if the rubber is not of the very best, a breakdown of insulation will soon occur. The better method is to fix the contact gear permanently to the span wire, and have an independent traversing carriage to draw the lamp to the side for lowering. Of course the lamp must be released from the fixed contact and lowered about a foot before this can be done.

N. D. W.

Preservation of Poles.

We have read with interest your interesting article on "The Preservation of Telegraph Poles" in your issue of December 22nd. We notice that you refer to the greasy condition of creosoted poles and recommend that they should be stored six months after creosoting, so that the oil adhering to the surface may get removed. This would add materially to the cost and, in many instances, would be impossible. You also refer to the draining out of oil after the erection, with the consequent fouling of streams and wells.

Both these disadvantages can be obviated by having telegraph poles and other timber such as fencing creosoted by the new Rüping process, by which a better penetration of the timber is secured and the wood is dry and clean and consequently fit for immediate erection. There is no subsequent draining out of the oil and consequently nothing to foul streams and wells.

This process is gradually superseding the older methods, and on the Continent and in America it has completely done so.

For **Richard Wade, Sons & Co., Ltd.,**
W. L. SHOOTER.

Hull, *January 16th*, 1912.

Official Returns.

In your issue of the 19th inst. we notice the following paragraph under heading of "Official Returns of Electrical Companies":—"General Electric Co., Ltd. (67,307).—Mortgage dated December 21st, 1911, supplemental to trust deed dated November 30th, 1900, securing £200,000 first mortgage debenture stock, charged on land at Witton, near Birmingham. Trustees: F. B. Ross, Cromford Court, Manchester; and W. Warburton, 15, Norfolk Street, Manchester."

In our opinion, this announcement is distinctly calculated to convey to the public at large that there has been a new issue by our company of £200,000 mortgage debentures. Such, however, is not the case. All that has been done is to release one security from the operation of the original debentures for £200,000, which were created by a trust deed dated December 30th, 1900, and substitute another security with the consent of the debenture-holders.

We shall be glad if you will in your next issue correct the erroneous impression conveyed by the above paragraph.

The General Electric Co., Ltd.,
M. RAILING, *Director.*

London, E.C., *January 22nd*, 1912.

The Association of Consulting Engineers and the I.E.E.

Referring to the rules drawn up in connection with the above, No. 4c requires that no consulting engineer can be a member of the Association unless he is a member of the Institution representing his profession. This appears to be unreasonable.

I have been in practice for nine years as a consulting electrical and mechanical engineer, and I belong to no Institution. Why should it be necessary for me to join the Institution of Electrical Engineers if I want to belong to the Association of Consulting Engineers?

Is it sentiment? Is it that the Consulting Association want the backing of the Institution and the advantage of using their building, or have the Rules of the Institution been so strict in the past that a Member is sure to possess special qualifications? It seems to me a very unnecessary rule—a man's qualifications can be gauged without it; in fact, it is rather like the cotton Trade Unionist swearing he won't work with a non-Unionist. However, it may save me

a guinea—perhaps a great many, as I am free to work without restriction.

I applaud the efforts of Mr. Ferranti to improve the status and value of the Institution of Electrical Engineers. I believe he stated publicly that it is of little value to its members as it stands, and many of its members are fairly blunt in their statements as to its lack of status and value—yet the new Association binds its members to be members of an Institution which has some lack of status and value.

It would be an advantage to be a member of the Institution if every Electrical Association were a branch of the Institution, and partly under its control—while retaining self-control in each branch.

The Institution would increase its funds by each branch paying in subscriptions, also its power, and, further, each branch would have a status and more power than at present. I believe the only objection held in the highest quarters is that some of the present members of outside Associations are not qualified electricians, but surely that could be got over.

The member of a branch need not be admitted a member of the Institution, although branches will act as feeders to the Institution and also provide a means by which men will be educated up until they possess the qualifications for membership of the Institution.

F. G. C.

Cheap Disconnecting Boxes.

There are many undertakings which find the cost of a sufficient number of mains disconnecting boxes of good design to be more than the job will stand, and they therefore put in very few, and thus find themselves in an awkward predicament in the event of a main breaking down.

After many years' experience with mains work in seven distinct districts, I have come to the conclusion that the best arrangement is an underground chamber with two or three bus-bars each mounted on insulators on a separate wall of the chamber. Where single cables are in use, the ends are sealed and thimbles sweated on which are fixed to the bus-bars with set screws.

Where the cables are concentric or triple-concentric, the cable ends should be sealed with compound, and the conductors sweated to suitable concentric fittings, from which rubber insulated tails are led to the bus-bars.

Of course, if the chambers are liable to flooding, a switch pillar above ground is the alternative, but these are liable to damage from vehicular traffic. However, both the above arrangements are costly, and for my own work I find that a shallow brick box with frame and cover varying from 12 in. × 12 in. to 24 × 24 in., according to the size and number of the cables answers every purpose. The cables are terminated in ordinary sealing troughs filled with compound, and rubber insulated tails are sweated to the cable conductors by means of the usual fittings. The tails are each fitted with a copper sweating thimble, and those belonging to each pole are fixed to a short piece of bus-bar fitted with a set screw for each. The whole is then taped up.

To the lead sheath of each cable there is soldered a heavy strip of lead with a hole in the end, and a brass bolt then bonds the whole of the leads together. The cables are each independent, and can be removed, or additional ones can be added with small expense, whereas the ordinary disconnecting box has to be entirely dismantled for each alteration.

I find that the total cost of a seven-way box complete with labour, re-instatement materials, &c., in a brick pit with 24 in. × 24 in. frame and cover does not exceed £5.

I should like to have criticisms on the above arrangement from practical mains engineers.

Arch. J. Howard.

Taunton Electricity Works,
January 19th, 1912.

The Prevention of "Steamy" Shop Windows.

At the present season of the year both the shopkeeper and the lighting engineer are faced with the difficulty of "steamy" windows, which have a disastrous result for both. The shopkeeper is unable to display his goods to the best advantage; and the engineer casts a sore eye on the light he is supplying, hidden, as it were, under a bushel.

To combat this, various systems have been tried—gas has been used; and how often has gas made its way into shops for this reason? Comment is needless. We notice that on a cold day that "steamy" windows are all prevalent in shops where the entrance door is kept closed, whereas in butchers' shops, this is not the case; they are provided with good ventilation, hence a very slight difference of temperature between the outside and inside of the shop. All tradesmen cannot provide such ventilation, for on damp days their goods would be affected, so some other method must be adopted.

The writer has found that the cold air outside has a tendency to freeze the air inside the window. Hence condensation sets in, and eventually we have water running down the glass inside, which, if left there, freezes.

To burn gas jets is of very little use, as the heat given off rises, and we find the top clear, but the bottom, which is the most important part of the show case, is "steamy."

To prevent the air nearest the glass in a confined window from depositing moisture it must be kept in circulation. To introduce fresh air into the case, either hot or cold, is disastrous to a jeweller, consequently a small fan must be used, say, with blades of 4 in. diameter; such a fan, however, is not on the market to work direct on 250 volts, and should a larger fan be used, the tickets are blown about, and it has a tendency to draw in fresh air.

An experiment was tried in a jeweller's window, which consisted of six air-tight compartments; six fans were required, and to obtain the small fans to work on 250 volts direct being impossible, six 4-volt fans were procured; these were found to take 2 amperes from a 4-volt cell, when running at a good speed. The lighting of the shop being by electricity, the six fans were run in series with one another and the lamps in the window, a single-pole switch short-circuiting the fans when not required. By this method the speed of the fans could be regulated by switching on or off the lights without causing a noticeable drop in the voltage, so that it did not interfere with the lighting. Five minutes has been found ample to run the fans as soon as any signs of "steam" are noticed, and the effect will hold good for perhaps half-an-hour or more, according to the state of the weather.

I must say I do not advocate the method of running the fans through the lights, but being unable to procure such small fans to run on 250 volts, I had no alternative. It is only left for the fan makers to design such fans, which I am sure will be to their advantage and that of the supply authorities.

A. Preston, *Electrical Engineer, Ammanford Electric Supply.*

January 22nd, 1912.

Electric Cooking and Heating.

I did not reply last week to the letter sent you by Mr. Meares, as I felt sure others would only be too ready to disabuse him of the idea that there is anything difficult in replacing the kitchener with electrical apparatus.

At present it is true that the modern household is not run entirely by electricity, but it will be very soon. How long was it between the introduction of gas and its almost universal use? I don't know, but I expect we shall beat it easily.

Electricity can cook perfectly, it can provide at a reasonable cost all the hot water necessary. Even if the radiator or electric fire is felt to be a little too good for the servants to sit round, give them a small open fireplace.

You cannot economically produce a large quantity of hot water electrically at the moment it is wanted. Neither can you by any other method. The coal fire does it slowly. The gas geyser is horrible, and takes, say, 15 minutes for 30 gallons.

Electricity, as I have shown before, can produce it very well without any patent or expensive apparatus, without anything likely to break down. It may cost a little more, but it is cleaner and better.

For example, in a house holding a family of six persons and four servants, it would cost to cook and heat water by electricity, say, £80-£100 per annum. Using a kitchener, the coal for it would be, say, £30-£40. One servant less could do the work. This seems to me to be a business pro-

position. I expect I have much overstated the electricity consumption, but it is near enough.

The cost of installation of the water heater would be, say, £5.

The complaint that makers of cooking apparatus do not supply means for heating persons and water can easily be answered. They do. A few specialise, but most do it all.

Smaller establishments can easily be dealt with, perhaps at present not so cheaply as with coal or gas, but so much better that it is worth the extra.

Finally, if Mr. Meares's friend will not go the whole hog, let him cook by electricity and fit a small closed stove for the hot water. He would save its cost very quickly. People seem to think because a kitchener does everything it is cheap. Generally it is a jack of all trades and master of none. It is not comfortable to sit round in the evening. It is wasteful of coal for hot water and a bad cooking appliance.

Percy Good.

London, S.E., *January 22nd*, 1912.

PROCEEDINGS OF INSTITUTIONS.

Auxiliary Machinery for Internal Combustion Engined Vessels.

BEFORE the members of the Institute of Marine Engineers, London, on January 15th, MR. W. R. CUMMINS read a paper on the above question.

MR. CUMMINS pointed out that it was desirable, if not necessary, that the same type of motive power should be used throughout the ship. In the case of internal combustion engined ships some difficulty arose. He went into details of mechanical, hydraulic, compressed air, and electrical methods of driving the auxiliaries, including various types of electrical steering gear that had been proposed, and in some cases applied to actual ships. He explained one of the difficulties met with when applying an electric motor to the steering gear; if a steam steering gear were to get out of control and put the rudder up against the stops, or if a heavy sea struck the rudder, the engine would pull up, and no damage would be done, and the engine would start up again when the excessive load was removed, but in the case of the electric motor, if it were pulled up dead it would burn out if no overload cut-out were provided. On the whole, he thought that the compressed-air system would be best for the auxiliaries.

The CHAIRMAN (Mr. F. M. Timpson) in opening the discussion, stated that compressed air had been used for auxiliaries, on the oil-engined vessel *Vulcanus*, but the owners had reverted to the use of steam with oil-fired furnaces in later boats.

MR. W. P. DURTNALL said that many attempts had been made to utilise compressed air for the various purposes, but the compression and other losses were such as to make the over-all efficiency very unfavourable. Hydraulic gear was more efficient, but neither could compete with electrical driving for the purposes concerned. Recently, he had tested a 7,000-ton cargo vessel at Venice, whilst she was unloading her cargo, and had weighed the water consumed. The evaporative efficiency of the boilers was found to be approximately 9 lb. of water evaporated per lb. of coal burnt, but on weighing the coal used during three days' working, it was evident that as much as 29·2 lb. of coal was burnt per ton of cargo discharged, which was an enormous consumption for the work done; most of the consumption represented losses through radiation, &c.

The owners had since decided to install the "Paragon" variable-voltage system of electrical transmission on this ship, and Mr. Durtnall described in some detail this method of driving, demonstrating that a great advantage in the matter of fuel economy will result from its use. A high load-factor could be kept on the prime-mover in the engine room, and the kinetic energy of the falling weight, and of the mass of the motor and the winch would be recuperated in the form of electrical energy, which would be sent back to the mains. No resistances were used in connection with this system for starting and speed regulation, and as the steering-gear motor could stand if desired with the full current on at low voltage, the conditions of the steam engine would be met, and a great reduction in the fuel consumption per ton of cargo discharged would take place. He further stated that anything that could be done by means of steam could by proper design be satisfactorily carried out by electric motors, and with greater fuel economy, because of the higher thermal efficiency that could be obtained by quick-running engines as prime-movers compared with slow-working direct-coupled pumps, fans, &c., driven by steam or compressed air.

MR. W. MCLAREN considered that the deck machinery, such as winches, windlasses, and capstan, should be driven by electrical gear, especially as with hydraulic gear it cost just as much to lift 1 cwt. as to lift, say, 3 tons, on a 3-ton winch or crane. He thought, however, that either hydraulic power or compressed air could be used with advantage on the steering gear.

The meeting was adjoined for a further discussion on the subject at a later date.

Residence Tariffs.

By A. H. SEABROOK, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, December 14th*, 1911.)

THE cost of supplying a residence consumer with electricity is composed of two parts:—

(*a*) "Standing cost," or the cost of being "ready to supply" him, made up of capital charges, the greater part of management costs, a small proportion of repairs, wages, coal, &c., and all charges which depend upon the maximum power he requires at any one time.

(*b*) "Running costs," made up of a small proportion of management expenses, and the greater portion of repairs, coal, wages, oil, stores, &c., and all costs which vary in proportion to the number of hours per annum he uses power.

No tariff is theoretically sound which does not differentiate between these two sets of variable costs, and which does not charge the consumer separately as to his standing costs and as to his running costs.

Another factor also has to be taken into account in tariff making, and that is "expediency." It may be quite justifiable on commercial grounds (and by "commercial grounds" is meant from the point of view of the balance-sheet of the undertaking) to take a line of action which, viewed by itself, appears to be unsound. A tariff which does not allow for expediency will be a failure.

The characteristics to be desired in a residence tariff are:—

1. It should ensure a proper return from each consumer upon the total cost of supplying him, this cost being made up of standing and running charges, and the ideal tariff must take into account variables of each, and not assume them constant for all consumers.

2. It should be as simple as possible and capable of easy explanation to the consumer.

3. It should render unnecessary the use of more than one meter and one system of wiring, however varied the application of electricity, and it should hold out special inducements and facilities to consumers to make the freest use possible of the electric service for all the purposes that it can be adapted to; it should faciltate the installation of the greatest number of points and encourage the long-hour use of electricity for lighting.

4. It should be cheap in application as regards accountancy, book-keeping, and labour generally, and should eliminate as far as possible complaints from consumers, which, of course, means a saving in labour.

5. It should possess great flexibility as regards the number of lamps installed, so that a consumer may install and pay for exactly the amount of light he requires, and he should not be charged on any arbitrary assessment based on the amount of light which is considered necessary for his purpose.

Residence tariffs at present in use may be put under three heads:—

(*a*) *The Flat Rate per Unit.*—This is the most common system of charge; it does not take into account the consumers' demand, but merely his consumption of units.

(*b*) *Flat Rate Charge per Kilowatt of Maximum Demand and no Charge per Unit.*

(*c*) *Hopkinson Differential Rates.*—These consist of a primary and secondary rate of charge for standing and running costs, thus charging for maximum demand required as well as for units used. There ars various methods of applying the principles laid down by the late Dr. John Hopkinson.

The following are some of the best known varieties:—(1) Wright maximum demand system; (2) Norwich or rateable value system; (3) Detroit system; (4) Contract demand system (Handcock and Dykes); (5) Glasgow system; (6) "Metropolitan" system (7) "Telephone" system.

(*a*) THE FLAT RATE PER UNIT.

By this tariff the consumer is charged by meter so much per unit, with or without discounts, and regardless of his maximum demand. It therefore ignores an important item of cost, viz., standing charges, and it assumes that all consumers require the same proportion of units to their maximum demand, which is unsound and theoretically indefensible.

Another more serious objection, is that separate wiring has to be installed before electricity can be employed for "other uses" than lighting, because consumers will not pay 4d. or 6d. per unit to run kettles, irons, toasters, and such apparatus. There is a growing tendency on the part of residence consumers to make use of such auxiliary apparatus, and unsuitable tariffs should not be allowed to stifle the demand which is being so carefully and assiduously cultivated by manufacturers and some electric supply managers.

There is no doubt that auxiliary apparatus merely requires to be brought efficiently and tactfully to the notice of consumers and they will adopt it. This business may be encouraged to such an extent that these "other uses" units will yield as valuable and important a proportion of the total revenue as the power load in industrial areas. In fact, it would not be unduly optimistic to say that they will eventually become more important, as there is a bigger public to use electric heating and cooking than there is to use power, and the prices charged for electricity and electrical

apparatus are now sufficiently attractive to encourage a great and immediate expansion of business.

The flat rate per unit has another serious drawback. It does not encourage the long-hour use of electricity for lighting, such as basement lighting, a most desirable class of load which cannot be obtained in any quantity even at as low a flat rate as 3d., but which a differential tariff will nearly always secure.

In spite of the foregoing statements, there is little doubt that "expediency" demands a flat rate for lighting as an alternative to the differential tariff, but it must be a high flat rate, say not less than 6d. per unit.

Some of the London electric supply companies were severely criticised recently for raising their flat rates from 5½d. to 6d., but it was the proper and correct course for them to adopt, as they were introducing a differential tariff, and were, therefore, compelled to keep the flat rate high.

(*b*) FLAT RATE PER KILOWATT OF MAXIMUM DEMAND.

This is analogous to the unlimited "telephone" service rate. It consists of a weekly or monthly sum per lamp or per kilowatt or part of a kilowatt installed, and has generally been applied to lighting supplies only. Probably the best known application in this country is that by the Fixed Price Light Co., who have successfully introduced it into small residences in South London.

It has been applied on a small scale in St. Marylebone for artisans' dwellings, consisting of one, two and three-room tenements. The price per tenement is calculated, in the case of kitchens and sitting-rooms, in such a way that if the consumer uses his lamps day and night, the price per unit obtained would be a little under 1d., and lower in the case of bedrooms. In practice there is not much difficulty experienced from consumers wasting light, as in these blocks of tenements the caretaker is a person of considerable importance, and exercises a good deal of control over the tenants.

The price per lamp per week includes lamp renewals, and also a sum calculated to write off within a reasonable period the capital expended in wiring. For a single-room tenenent the charge is 7d. per week (one 25-C.P. Osram), made up of current, 4d.; lamp renewals, 2d.; installation repayment, 1d.; and for a bedroom 5d. per week (25-C.P. Osram).

About half the tenements adopted the system immediately it was available, and as new tenants come in all the tenements will be fitted up. If in the future the tariff is generally applied in the district, it appears from inquiries made, that by arrangement with the landlords the charge for electric light can be included in the rent, and the flats can be let inclusive of light. As it is, there is a tendency for flat owners to insist upon the exclusive use of electric light in their flats on account of the saving in decorations, &c., and there is little difficulty in inducing landlords to make this compulsory where contracts for a period of years have been entered into for electric lighting arrangements.

Messrs. Handcock & Dykes have put into operation a similar system, but a limiter is used in conjunction with it, the charge being based on the watts of maximum demand at which the limiter is set to flicker. It is as expensive, however, to put in a limiter as a meter.

The flat rate per kilowatt of maximum-demand system has very wide possibilities among small residence consumers where meters are impracticable on account of cost, and it seems to be the only solution at present of the small-consumer problem; at the same time, it is a very satisfactory solution, both to suppliers and consumers.

(*c*) HOPKINSON DIFFERENTIAL RATES.

It would be difficult to find an electric supply manager who would deny that the Hopkinson principle is the only scientifically correct basis of charge, whether he adopts it or not himself.

The question then arises, Why are there so many flat rates per unit in force? The answer is, Because of the difficulty of applying the Hopkinson principle in a simple and easily explained and understood system of charge, which complies with the requirements of expediency as well as with the laws governing supply costs.

The *Electrical World* says:—"It is indeed difficult for those who have studied this matter for years to realise the ignorance of the first fundamental principles of rate-making among some of the smaller companies." In this country the last sentence will apply to the large as well as the small supply authorities, because most of the large ones, which should lead the way, are peacefully sleeping upon inconsistent flat rates per unit.

It would appear that the correctness of Hopkinson's principles is quite as fully agreed in the States as here. In both countries the reason why tariffs on these principles make such little headway is the same, viz., the difficulty in applying those principles in the form of a simple tariff.

The best known of the Hopkinson systems are:—

1. *The Wright System.*—This system is well known, and needs no description. Its main disadvantages are: (*a*) It is impossible for the consumer to understand it, and that is a most serious bar to obtaining new business. (*b*) It is practically impossible for the consumer to use electricity for other purposes than lighting. (*c*) It is expensive in capital cost, meter and accounts department, and the cost of settling consumers' complaints is excessive. (*d*) Consumers do not, as a body, appreciate the value of the low secondary charge, consequently the system tends (with a few exceptions) to restrict the use of electricity.

2. *Norwich, or Rateable Value System.*—This is a differential system, in which the primary rate is a fixed percentage of the rateable value of the house, all units being charged at a low price of 1d. or thereabouts.

It has several advantages, being extremely easy for the consumer to understand, and therefore a good "business getter"; it is cheap in application, it encourages the use of electricity for other purposes than lighting, only one meter and system of wiring is required, and it encourages a liberal use of electricity for lighting.

It has, however, several serious drawbacks. It is an "inflexible" rate, because it assumes that each consumer in each similarly rated house requires the same number of watts for lighting, whereas in practice it is found that the requirements of different persons in similar houses differ enormously. It relies upon houses assessed at the same amount for rating purposes requiring similar installations of electric light. This must be a serious difficulty in nearly all districts.

Again, the rateable value of two houses of the same size and only one street apart from each other, may be very different.

3. *Detroit System.*—In this system the primary charge is based on the number of rooms in a house, &c., in the form of a predetermined number of units per room at a high price per unit, all additional units being supplied at a low secondary rate.

The author is not aware of any application of it in this country, but it is in use in Detroit and other cities in the States.

This system has some of the disadvantages of the Norwich system.

4. *Contract Demand System.*—On this system the primary charge is based on the connected load, and the consumer states his maximum demand required in kilowatts, at which figure a limiter flickers the lights when that maximum demand is exceeded. The system has many advantages as regards simplicity, and would be almost ideal if lighting were the only use to which electricity could be put. The disadvantage which puts the contract demand system right out of court is the impossibility of using electricity for other purposes than lighting; irons, kettles, &c., are all barred because they cannot be used at the high lighting rate of charge. In practice it is found that the diversity of this class of load taken in bulk entitles it to be charged at a much lower rate than lighting, which has practically no diversity.

5. *Glasgow System.*—The system recently put into force in Glasgow is as follows:—

Up to 800 hours' use of the maximum demand the primary charge is 3d. per unit (the present flat rate of charge) and all additional units 1d.—the secondary rate. The trouble is, however, that the consumer would be sadly alarmed at his first bill if he put in a kettle and an iron. This system will work out very differently from what is expected by the consumer, and instead of his units of increased use being at 1d. per unit they will be 3d. The only way to get over this difficulty is to assess the lighting maximum demand.

6. "*Metropolitan*" *System.*—The "Metropolitan" system, which is used by the Metropolitan and the Brompton (London) Electric Supply Companies, is based on the connected load and consists of three charges:—

(*a*) Primary kilowatt charge.

(*b*) First energy charge 2d. per unit, the amount in £ s. d. at 2d. per unit to be equal to the amount of the annual primary charge, then all units in addition are charged at:—

(*c*) The second energy charge at 1d. per unit.

The only difference between the "telephone" system (as the contract system is called in St. Marylebone) and the "Metropolitan" system, is the intermediate energy rate of 2d., and one would imagine that very few consumers get the 1d. rate.

There are so many good points in the system not possessed by systems of charging other than the "telephone" system, that this intermediate charge of 2d., even if it does complicate the straight annual charge and 1d. per unit system, cannot be considered to be any serious disadvantage provided it is found that consumers actually do get on to the 1d. rate.

7. *The "Telephone" System.*—This is a differential tariff based on the connected lighting load. The idea was first suggested to the author by Mr. Arthur Wright when discussing rates of charge for small consumers.

The system, as described in the paper, was the outcome of that conversation and of the various improvements made by the staff at St. Marylebone as experience was gained. The author fears that a good deal more credit has been awarded to him than he really is entitled to, as the only thing about it which he fixed was the name "telephone," and that was adopted for the following reasons:—

Practically all consumers, if not actually telephone subscribers, are acquainted with the system of charge for the telephone, which is roughly an annual sum, payable in advance, and 1d. per call. Calling the system the "telephone" system immediately causes people to think of the telephone charges and accustoms them to think of payments in advance. It has frequently been most useful to be able to show a consumer what the Telephone Co.'s annual charge covers in standing and capital charges, to explain how in like manner electric supply standing charges are almost identical, and that it costs the Telephone Co. and the Electric Supply Undertaking a certain definite sum to be "ready to supply" him apart altogether from the number of calls he makes or units he uses, and then to show him from which costs the 1d. per call and 1d. per unit are made up. It would be most difficult to explain all this to the consumer if the Telephone Co. did not exist. Thus the name is purely a "selling point."

Briefly, the "telephone" system is:—

(*a*) A differential system with its primary charge based on 70 per cent. of the connected lighting load at £14 per KW. per annum, not counting convenience and decorative lights, and not counting any watts installed for other uses than lighting. The secondary charge is an energy rate of 1d. per unit.

(*b*) The exclusive use of electricity for artificial lighting is insisted upon.

(*c*) The primary charge is payable annually in advance, or quarterly at an increase of 10 per cent. in the price.

(*d*) The primary charge is not increased in subsequent years provided the consumer does not increase the wattage of his lighting installation.

(*e*) Maximum-demand indicators are used in all but small installations and are put in circuit with the whole installation—lighting and "other uses"—not for charging purposes, but as a guide in noting the load factor of the entire residence installation. When sufficient information has been obtained these will be discontinued.

(*f*) It will be seen that the standing charges of the entire residence service are based on the lighting installation.

The advantages of the system are:—

1. Each consumer pays his share of standing and running charges and separately. If he chooses to use his service only for lighting, that is his loss; the fact remains that it is open to him to use it for other purposes than lighting at no increase in the annual charge.

2. The system encourages longer hours' use per annum of lighting and does not encourage economy in units.

3. A large amount of "other apparatus" than lighting can be connected to the lighting circuits without the expense of separate circuits and meters.

4. The system has not the disadvantage which many differential systems based on the connected load have, namely, discouraging the free installation of lighting points, because convenience and decorative lamps are not counted.

5. The system has not the objection which many differential tariffs have, viz., assuming that all consumers of equal size require the same amount of light. On the "telephone" system the consumer has to wire his house throughout, but he can have and pay for the number of lighting watts that he wants.

6. The system is extremely simple in application, merely consisting of a quotation of so much per annum and 1d. per unit, and it is easily understood by the consumer.

7. It practically eliminates the possibility of complaints, as these can only refer to the number of 1d. units, and consequently strict meter accuracy is not so essential as when units are being charged at 4d. and 6d.

Seventy per cent. of the lighting watts installed may be considered high (several electric supply managers have adopted 60 per cent.), but convenience and occasional lights, such as those used in cellars, pantries, bath-rooms, lavatories, larders, and occasional rooms are not counted, nor are lamps counted which are used for purely decorative purposes, provided there is already 1 watt per sq. ft. of floor space (based on tungsten lamps) installed in the room. This proviso is obviously necessary to prevent a consumer claiming nearly all the lamps installed in a room as decorative, which in some large houses it would be possible to do.

It is found in St. Marylebone that a very small house or flat uses on the maximum demand system 80 per cent. of the lamps installed at any one time; as the size of the house increases the percentage decreases to 33⅓ in the largest houses. The larger the house, however, the greater the number of convenience and decorative lamps, which brings out the 70 per cent. about right.

One penny per unit was taken for the secondary rate because it is a rate at which consumers can afford to use electric heating and cooking, as at that rate electricity can compete with gas.

One penny per unit is also quite a safe figure from the point of view of cost per unit in St. Marylebone, but this is a matter which each supply manager must consider for himself, because conditions differ in nearly every district. In some cases the rate could profitably be ½d., but it is a pity to charge as low a price as ½d. per unit for cooking and heating, unless for the six summer months only (¾d. per unit is now being seriously considered in St. Marylebone as a summer rate and 1d. in the winter), as there is such a large amount of business to be done at 1d. before there is any necessity to go any lower in price.

The exclusive use of electricity as an artificial illuminant is one of the essential points of the system. It would be inadvisable at the moment to offer, with no restriction, 1d. per unit for all "other uses" than lighting in St. Marylebone, but if the exclusive use of electricity for lighting can be obtained and thus the full standing charge on the premises, then 1d. per unit for "other uses" is remunerative. It would surprise many people to know what the results are. A typical case may be cited, one of many. A consumer came to the showroom and purchased a radiator. The showroom attendant immediately enlarged on the advantages of the "telephone" system; the result was that 19 gas light points were changed to electricity, "telephone" system and maintenance contracts were obtained, and an order for several more radiators.

In St. Marylebone, during the first two years of the "telephone" system, nearly £25,000 was received in annual payments in advance. Here, again, the Telephone Co.'s charge helped considerably. An increasing sum is carried forward each year in the form of unexpired annual payments; this materially assists to increase the working capital of the undertaking. In a short time, in spite of the very large half-yearly payments on account of capital charges, there will be a credit bank balance on revenue account all through the year.

A large business is done in hire and hire-purchase, the capital expended on which it is considered preferable to write off at the end of each year instead of raising loans, and a large working capital is particularly useful in this case, which is only one example.

Altogether there is no reason why annual payments for electric supply should not be obtained in advance just as telephone subscriptions are. Although quarterly payments in advance are accepted at 10 per cent. increase, the number of consumers paying quarterly is negligible.

The following is printed in large red type on all agreement forms:—"The annual charge in future years will not be increased provided you do not increase the number, candle-power and watts of the installation as per schedule attached."

No claim is made for the "telephone" system being perfection, but the author believes that for the time being it is preferable to base the primary charge of differential residence tariffs on the connected lighting load.

It must be borne in mind, however, that when the complete electric service—lighting, heating and cooking—is installed in residences, the proportion of lighting revenue to the total revenue per residence will be about one-third to one-half, and the whole aspect of residence supply will be changed. The lighting load factor will not then be the dominating factor; lighting and heating will be still essentially winter requirements, cooking, taken in the aggregate, will be largely non-peak. Many other accessory uses, such as fans, bath-water heating, polishing, ironing, &c., will also be found to be largely non-peak.

One point as to the diversity of the cooking load might be worth mentioning. From recording ammeter charts it is found in St. Marylebone that even where late dinners are the custom in an ordinary family, the midday cooking load is generally greater than the evening, perhaps due to the fact that the children, maids, governesses, &c., have a middle-day dinner, and also that a good deal of food is cooked in the middle of the day and early afternoon for the evening meal, as naturally the average cook prefers to leave as little as possible to be done in the evening. A large number of these recording ammeters are kept going in order to ascertain the diversity of load in various residences and blocks of flats, and the information accumulating is most valuable.

Probably the optimist will say that in a few years' time, when electricity is universal, it will be possible to offer a flat rate per unit of 1d. or less, and it will not be necessary to bother about differential tariffs. It is difficult to see how that can come about, because there will always be the long and short-hour users, and they cannot be fairly charged at the same rate per unit. A universal flat rate must be as unfair in the future as at present unless some genius abolishes load and diversity factors.

DISCUSSION.

The paper was discussed on December 14th, 1911, and January 18th, 1912.

MR. E. T. RUTHVEN MURRAY, in opening the discussion, remarked on the importance of tariffs in view of future developments due to "other uses." He wondered whether one of the principal benefits of the telephone system was not that it did not differentiate between standing and running costs; perhaps expediency was a valid reason for its adoption. The system adopted by the author only assessed lighting charges, and left "other uses" to chance, but electric cooking was growing, and ought to be assessed as well, if of any amount. How did the author satisfy himself that it was remunerative to charge 1d. per unit for other uses? If he charged £14 per KW. for lighting—a high fixed charge—other uses should be charged something. No tariff ought to necessitate entering a consumer's premises, and he thought the author's forms (in an appendix) were somewhat appalling. He discounted any advantage in name, but agreed with the author's premises as to what a tariff should be.

MR. GEORGE WILKINSON said that while the name "telephone" was new, the system was old, and had been used by himself for some years. In referring to current limiters, the author lost sight of the fact that there was no shunt loss in the limiter, and this turned the scale as against a meter. The contract demand system (with limiters) was essentially for workmen's dwellings where only lighting was in use. The author obtained £14 per KW. standing charges in advance, but he (the speaker) only obtained £9 per KW. of maximum demand. The author had no check on his assessed demand, as it was easy to change lamps, and he ought to be glad to obtain 1d. per unit as well as the £14 per KW. The "other uses" referred to were limited by the service's capacity. A large house which might take 1 KW. for lighting, would, perhaps, take 6 KW. for cooking and 3 KW. for radiators, and thus other uses would soon load up the mains and necessitate additional capital charges for cable. He thought it would soon be necessary to make a KW. charge to cover such items.

MR. ARTHUR WRIGHT said the author had given practical proof of the business-getting capabilities of his system, but it appeared that rather too much was left to the discrimination of those who assessed an installation. The author did not appear to allow a commercial discount for quantity, and reduction in costs was more due to quantity than to improved load factor. In an average house the cost of electricity consumed was small compared with standing charges on mains, cost of collecting accounts, &c., so that small installations ought to be charged on the lamps installed. It was necessary to meet this class of consumer, who represented the great bulk left to be dealt with.

MR. C. A. BAKER (L.C.C.) said that body consumed 2¼ million units per annum for lighting its offices, schools, &c., of which more than half was purchased from 27 different supply undertakings. In Marylebone he had never been tempted to adopt the telephone system, as the standing charges were too heavy, and it would cost more than on the maximum-demand system with a rebate for large consumption. Only one London undertaking (Stepney) relied on the maximum-demand system, and there electricity was cheap. The author relied too much on expediency; he got his standing charges paid but if the consumer left or was away, the department

did not return the money, although it was not really entitled to more than the statutory charge per unit. In Lombardy, with water-power, it was usual to charge 15s. per lamp per annum, and this was justifiable with water-power, however long the lamps were used. He suggested that it should be possible to frame flat rates based on averages, much on the lines of insurance business; and that it would be a good thing for the business if unnecessary rules and regulations were abolished.

MR. W. R. COOPER said he favoured the Hopkinson system, and was glad to see that it was going ahead, even under another name; he had no belief in a flat rate. If he were a consumer on the telephone system, he would expect a 10 per cent. discount for paying quarterly in advance, instead of paying 10 per cent. extra. It was, however, much more important to get business than to worry about a tariff, and if business resulted from the telephone system it was satisfactory.

Mr. A. H. DYKES said tariffs largely depended on the people who were supplied, but also on the system of supply and plant. A flat rate was absurd unless one could store cheaply. The original Hopkinson system tended to reduce the number of lamps installed, and the Wright modification was supposed to get over this difficulty. The author's system was the contract demand system with the indicator omitted, but the limit indicator was inserted in order to fix standing charges for other uses according to the demand. It seemed, from the figures given in the paper, that the author was obtaining a very high price for lighting units, and so it was easy to supply at 1d. per unit for heating, &c. The system required inspection and differentiation between lights, which was a drawback, and he thought that a good deal more would be heard of two-rate systems in future. In conclusion, he drew attention to the operations of the Fixed Price Light Co. among small property in South London, where 300 consumers had been obtained in face of the competition of an energetic gas company. The average cost of services was 10s. each, and the company paid 10s. per point for wiring, exclusive of the lamps, which were hired at 1s. each for the life of the lamp, thus, to some extent, relieving the consumer of their cost.

MR. A. K. SCOTT-MONCRIEFF, referring to the consumer who was away for a period, suggested that he ought to be charged less if away in the winter. It was not a "selling point" to ask a consumer to pay five-sixths of his bill beforehand; the £14 per KW. reminded him of overweight butter. The telephone system was, however, a good one; a system of this sort was required or else double wiring was necessary, but he thought that the flat rate would come eventually, as some industrial towns were getting very near it, the peaks in those cases being of small importance and relatively of small cost.

MR. F. M. LONG, referring to the Norwich system, said it would probably not be suitable in a place like Marylebone or at seaside towns. A system of primary and secondary charges was the right one for a private house, and the former should be fixed and independent of what the consumer did in his house. The Marylebone figures for primary charges were high compared with Norwich, where £4 per KW. connected was an average. There were, however, 2,500 consumers connected on the Norwich system, two-thirds of whom were private consumers.

MR. A. B. HORSLEY said that at Harrow, where there were numerous small consumers, in 1907, there were 1,047 consumers, of whom 14 per cent. were supplied through slot meters at 8d. per unit. The average consumer's revenue was £8 per annum, but the slot meters only averaged 26s. each. They now offered a rebate after the first 5s. per quarter was paid, on condition that the consumer gave notice before leaving, and this, with nearly double the number of slot meters, had increased the revenue to 32s. 6d. per meter. The average price obtained represented 1s. 8d. standing charges per quarter, and 5½d. per unit supplied.

In opening the adjourned discussion (January 18th), MR. J. S. HIGHFIELD said a tariff should be framed to extract such a price as would return a reasonable profit. Owing to such a large share of the supply business being municipally controlled, the question of profit was to some extent obscured, although it was a vital matter if new capital was to be introduced into the supply business. He pleaded for more uniformity of rates in adjoining areas. With flat rates one could not use the same service for both lighting and cooking supply, and a fixed charge and low rate per unit enabled this to be done. He did not hold with the idea that one could alter the habits of a consumer by the tariff, and complained that neighbouring authorities often reduced their prices when there was no necessity for doing so, as he did not believe that price was such an important factor in obtaining new business. It was a strange thing that the slot meter system, although successful in the case of gas, was, on the whole, a failure with electricity; systems embracing fixed charges were not really successful, but he had found a contract system including a fixed payment of 1s. or so per week, and 1d. or 2d. per unit consumed, to be successful where the slot meter failed. It was, he thought, a great mistake to reduce the price of energy for cooking to very low figures, as the actual cost of supply was not really known.

MR. L. BUCKELL considered that the form of the tariff was of more importance than the actual price, and most important was what the consumer thought he was going to pay. A tariff should depend both on the state of the undertaking, and on the area to be supplied. He had been disappointed to find in the case of a 12-room house that the lighting, heating, and cooking load peaks coincided with the normal peak load, and more complete information on the point was desirable. By introducing a flat rate in his district in place of the maximum-demand system, the average price had been raised $\frac{1}{10}$d. per unit owing to increased turnover due to a simple rate, and he thought the importance of load factor might be over-rated in supply work. Load factor only affected the generating plant, and the question of increased turnover required more attention. It might be disadvantageous to have a tariff which discouraged additional lighting, and reduced the turnover, though improving the load factor. He had adopted a modified Norwich system, charging 2s. 6d. in the £ on the rating of the house, and 1d. per unit consumed, and this system was understood by the ordinary ratepayer.

MR. E. COWAN, going back to first principles, pointed out that price was a compromise between the factor of demand and the cost of production. The telephone system had some particularly good points; it embodied the principle of classification. The author said it was expedient to take a line which was apparently unsound, and he (the speaker) believed he was on the right road.

MR. A. J. CRIDGE did not agree that meters should be discarded, recalling a case where the substitution for one meter of separate meters on individual services had resulted in a reduction of the amount of energy supplied but an increase in revenue. The Norwich system was based on the ability of the consumer to pay, and it was quite justifiable to charge in that way. He questioned the legality of restricting a consumer to one class of illuminant, and suggested that the author's method of determining maximum demand was rather lax.

MR. W. E. BURNAND thought that "other uses" would probably swamp the lighting supply, with the probable introduction of further improvements in the latter, and suggested the possibility of differential rating corresponding to the class of supply. He thought that an attractive case had been made out for the telephone system.

MR. A. H. SEABROOK, in replying, said that price was not the primary factor in electric supply; business-getting methods were more important. The gas people were following electrical methods closely, and he understood they were now getting out an oven with an enclosed cooking chamber as a result of the criticism of gas cooking methods. As regarded the modified Norwich system based on rateable value, it would be difficult to make a man pay more for electricity because his assessment was raised. He quite agreed that all units supplied should be metered; at the John Street dwellings they had found the price per unit to work out almost the same as the maximum-demand price. The Norwich system had advantages in the case of more economical lamps being introduced. The question of expediency had attracted a great deal of attention—he failed to see why it should not be allowed; he could not see why a low-priced short-hour motor unit should be preferred to a low-priced cooking or heating unit. The telephone system might not be technically correct, but it was not arbitrary like the Norwich or Detroit systems. The high initial charges at Marylebone were, of course, due to the heavy capital charges there. In reply to Mr. Wright, he pointed out that discount for quantity in the case of the telephone system was met by a reduction in the fixed charge per KW.; he quite agreed as to charging a lump sum per lamp per week for small consumers. The L.C.C. school lighting in Marylebone was an unremunerative load, supplied under an old tariff agreed with the Metropolitan Co., which had not been altered. With the Norwich system the consumer paid for an arbitrary standard of illumination, but with the telephone system the consumer paid for exactly the installation he wished for. He understood that the Norwich system was intended to be a reduction in price, which might explain why it was largely adopted; the Marylebone tariff was intended to encourage "other uses," but not to give a reduced price.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Tesla Steam Turbine.

A turbine recently devised by MR. NIKOLA TESLA presents an interesting departure from orthodox views on this subject. Mr. Tesla dispenses with blades altogether, and relies wholly upon friction for the propulsion of his rotor. The accompanying illustrations, published in the *Engineering News*, show how he applies the idea. The steam enters through an expanding nozzle, and strikes tangentially a series of closely set steel disks, between which it follows a spiral path to the central outlet. The velocity of the steam being very great, and the friction between the steam

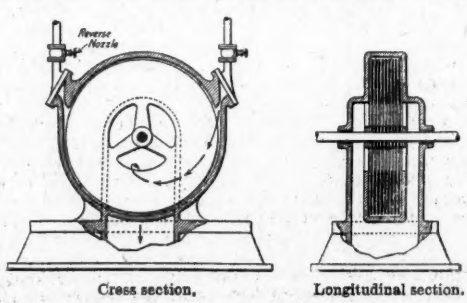


FIG. 1.—TESLA TURBINE.

and the disks being assumed to be proportional to the square of the difference in velocity, the turbine exerts a large torque when starting or running slowly; at higher speeds the difference in velocity decreases, but the path of the steam is lengthened by the action of centrifugal force, so that the torque is maintained. With such a turbine reversing is effected simply by applying a second nozzle acting in the reverse direction, as shown.

A turbine of this type with 25 disks, 18 in. in diameter, was tested by the New York Edison Co. with steam at 125 lb. pressure, exhausting to atmosphere; the speed was 9,000 R.P.M., and the output 200 H.P., the steam consumed being about 38 lb. per H.P.-hour. The set weighed 400 lb., and occupied a surface of 20 × 35 in. Mr. Tesla claims that the consumption can be reduced to 10 or 12 lb. per H.P.-hour.

Bell-Push Fire Alarm.

An ingenious device has been patented by MR. F. R. C. JOYCE, of Oak Road, Farnborough, Hants., for utilising the ordinary bell circuits for fire-alarm purposes. It consists, as shown, of a bell-push mounted on a perforated metal base, within which is an automatic contact connected in parallel with the push, on the base of which it is fixed. The contact maker is a compound metal strip with a gold-

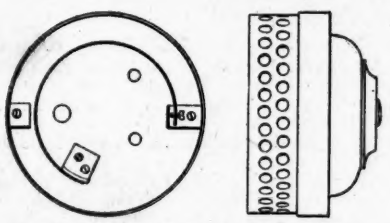


FIG. 2.—JOYCE PATENT BELL-PUSH FIRE ALARM.

tipped adjusting screw, which makes contact when the temperature rises above a given value, and rings the bell to which the push is connected. By this simple means, every room in a house in which a bell-push is fitted can be protected, and the system is self-testing, as the failure of the battery or circuit is at once detected in the ordinary use of the push. The position of the fire is also shown by the indicator.

New Wiring System.

We were recently favoured with an opportunity of inspecting a new system of wiring buildings, such as factories, offices, &c., by the courtesy of the inventors, MESSRS. FOOTE & MILNE, LTD., of 66, Victoria Street, S.W. The system is as bold in conception as it is simple in execution; it consists essentially in the use of bare

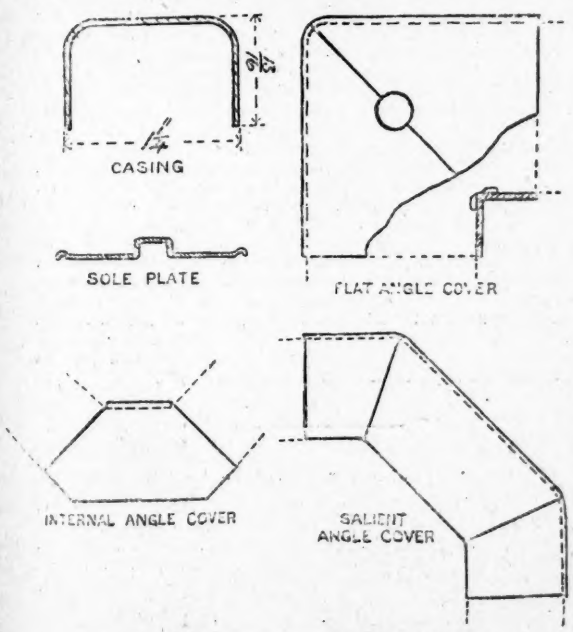


FIG. 3.—DETAILS OF CASING AND ACCESSORIES.

copper wires in steel casing, and is probably the cheapest system yet put forward. The parts employed, which are few and simple, are shown in the accompanying figures. The casing (fig. 3) consists of a "sole-plate" of steel strip with a corrugation in the middle, which is punched where required and screwed to the wall or partition and a cover of steel drawn into the form of a trough, which is secured to the sole-plate by bolts with tee-heads, the tee fitting into the corrugation above-mentioned. The bolts are spaced at intervals not exceeding 4 ft., and at all angles, tees and switches, and are placed in position before the sole-plate is screwed down. Over each bolt is placed a porcelain insulator of the form shown in figs. 4 and 5; this, it will be seen, is provided with projections undercut sufficiently to retain a wire, and staggered so that the wire, when bent into place, cannot be pulled through without great force. In erecting the wires, they are bent into these insulating holders, and drawn tight from one insulator to the next; the operation of stringing them up is obviously very easy and takes up very little time. To provide against any possible slackness and expansion due to temperature rise, it is thought necessary to place

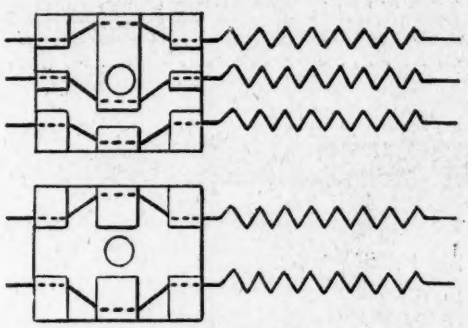


FIG. 4.—UPPER AND LOWER SIDES OF INSULATOR.

the wire under a slight additional tension, and this is effected by means of a special tool which crimps a few inches of the wires, as shown in fig. 4. It is found that the resulting spring tension is sufficient to keep the wires clear of one another and of the casing in a horizontal length of much more than 4 ft., the maximum allowed. The crimping is done close to an insulator, where the wires are rigidly supported, to prevent any possibility of their touching one another. This done, the cover is placed in position with a steel saddle piece over the joint, and secured by a nut on the bolt. Special accessories, as stated above, are few, and very simple; they consist of elbow and tee-joint covers, angle-pieces, &c., all of steel, as shown in fig. 3. Joints in the conductors are made with porcelain-covered couplings of the well-known type.

A special feature of the system is the continuity of the earthing shield. The sole-plate and steel cover are always arranged to break joint, and are in contact throughout their length; the saddle pieces are also in contact with the covers and the bolts, and it is believed that lack of continuity can hardly be possible. No attempt, of course, is made to render the system watertight; on the contrary, ventilation is provided for. It is claimed that the

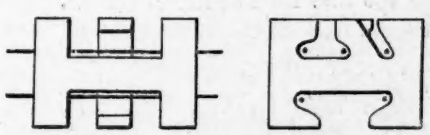


FIG. 5.—SIDE AND END VIEWS OF INSULATOR.

system is absolutely safe and self-testing; for either the insulation resistance between the conductors and to earth is extremely high, or there is a dead earth or short-circuit which would blow the fuses. But it is highly improbable that contact would occur, once the conductors were in place and the cover secured in position.

The insulators are made in two standard patterns, for four and five wires respectively; the five-wire pattern is shown in figs. 4 and 5, which also illustrates the mode of crimping the wires. Any less number of conductors may, of course, be used. An installation fitted up by Messrs. Foote & Milne on this system has been in use for six months without any trouble arising, and their offices have recently been wired with it for demonstration purposes; a circuit has also been run out of doors to ascertain whether there is any risk of corrosion or incrustation of the insulators in a damp situation, and so far no effect of this kind has been observed. Accessibility is obviously a prominent advantage of the system.

The device is not considered suitable for domestic purposes, on æsthetic grounds, but it is well adapted for use in offices, shops, and factories; ordinary switches and roses, switch-boxes, &c., are employed in conjunction with it, and lamp brackets are wired with covered conductors in the usual way. The system appears to possess marked advantages, and is well worth examination.

"Leuconium" Lamps of Low Candle-power.

THE STEARN ELECTRIC LAMP CO., LTD., of 47, Victoria Street, S.W., have succeeded in producing high-voltage lamps of small candle-power, with metallic filaments; these are made of 15 watts for 200 volts, giving 9 C.P., and 20 watts for 200-250 volts, giving 12·5 C.P. For 100-125 volts similar lamps are made, taking 8 to 10 watts, and giving 4·5 to 6 C.P. We understand that these lamps are ready for delivery from stock. The company have sent us a sample, which closely resembles their ordinary "Leuconium" lamps, and burns, of course, quite well on our 200-volt circuit. While the supply station engineer may not be altogether delighted with this further development of the metallic-filament lamp, there is no doubt that it will prove most useful to consumers for places where not much light is required.

E

E.M.B. Grid Resistances.

These resistances, for which MESSRS. SCHOLEY & CO., LTD., of 151, Queen Victoria Street, E.C., are the sole selling agents, represent a material advance upon the cast-iron grids hitherto used for tramway and railway equipments, cranes, haulage gears, &c. They are made of unbreakable and jointless material, the successive grids being bent to shape out of a continuous length—apparently without limit—of wire or strip; thus the danger of open circuit in the resistance frame is reduced to the minimum. The loops formed by the conductor between successive grids form convenient points of attachment for intermediate resistance steps, and the grids are

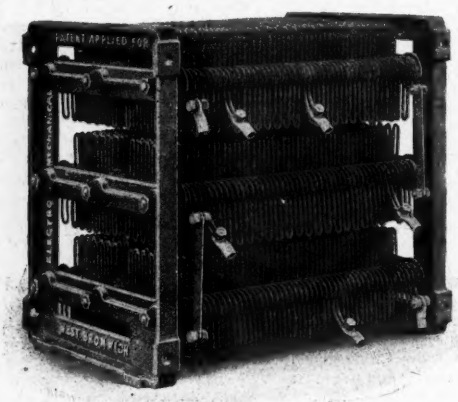


FIG. 6.—STANDARD E.M.B. GRID RESISTANCE FOR TRACTION.

clamped between mica washers, so that the resistance can be run red hot without fear of injury or distortion. The E.M.B. wire has a temperature coefficient similar to that of cast-iron, an advantage in many cases; but other alloys, of constant resistance, can be substituted if desired. The material is also rustless, and does not scale. The grids have been widely adopted for electric traction, and are very suitable for all such applications, being capable of withstanding the roughest usage; for export purposes they are admirably adapted, as breakage is avoided. Fig. 6 shows a standard type for electric traction.

The M.E. Printing Motor System.

We recently illustrated the new "Marryat-Elliston" equipment, which has been introduced by MESSRS. MARRYATT & PLACE, of 28, Hatton Garden, E.C., for driving machines and other apparatus in which a very large variation of speed is necessary, especially where reversing is required, as the apparatus will work equally well in either direction. It has the advantage of having a good efficiency characteristic through the whole of its working range. We have since obtained further particulars from the makers, which enable us to explain the mode of operation of the device. The equipment consists of a simple shunt or compound-wound direct-current electric motor, coupled to an electric clutch. The latter consists of two parts, both capable of rotation, and for the sake of clearness of explanation, we will consider this clutch as an electric motor, calling one rotating part the "armature" and the other rotating part the "field." The armatures of the driving motor and the clutch are rigidly coupled together.

The set is started up by running the armatures up to speed by means of an ordinary starter operating on the driving motor. The clutch field is then excited until the clutch armature generates a voltage equal to that of the supply, when the clutch armature is switched on to the mains. The motor has a large speed range by shunt field regulation, and if this field is weakened, the armatures will revolve faster. This will cause the clutch armature to generate current, and a torque is produced, which will cause the clutch field to revolve. The rate of revolution will depend upon the amount by which the armature speed has been increased. It is thus possible to obtain on the clutch field speeds from the very lowest to the maximum, which is limited by mechanical considerations, and a working range of at least 60 to 1 is possible by field regulation only.

This makes the equipment very efficient as compared with the use of diverting or series armature resistances for obtaining the lower speeds.

The machine to be driven is coupled to the set by means of a pinion or pulley mounted on the field portion of the clutch.

For control, it is only necersary to have a main double-pole switch, a push button or other motor starter and a shunt regulating switch.

Alu-Sol Flux and Solder for Aluminium.

WE have received from the ALU-SOL MANUFACTURING CO., Worcester Street, Wolverhampton, samples of their new flux and solder for aluminium, which, it is claimed, make absolutely permanent joints (joints made 14 months ago, and exposed to all weathers, are still unaltered), are easy to use and economical. The process is quite simple; we have made some joints between aluminium wires according to the inventor's directions, and find them as strong as could be wished, while, on dissecting them, we find that the solder has run well into the joints. The solder, in fact, appears to be much harder and stronger than plumbers' solder, and can only be torn asunder by the exercise of great force. Besides wires, all thicknesses of aluminium sheet, rods, tubes and stranded cables can be joined, without loss of conductivity, and alloys containing aluminium such as magnalium and duralumin can also be soldered with these materials. They are the invention of Mr. C. M. Bowes, and can be obtained from the company above-named. We understand that the Admiralty has had them under test for some months, and has placed a large order for them with the company.

LEGAL.

ELECTRICITY IN MINES.

ON January 16th charges against the manager and under-manager of the Pinxton Colliery, were down for hearing at the Alfreton Police Court, but a conference between the prosecutor and defendants, with their solicitors, resulted in the charges being withdrawn.

The matter is reported as follows in the *Sheffield Daily Independent*:—

At the instance of Mr. W. H. Pickering, Inspector of Mines, of York, Henry Stevenson, general manager of the Pinxton Colliery Co., and James Strachan, under-manager of the Brookhill Colliery, were charged with contravening special Rule 21 by installing and using electricity, and placing unenclosed fuses more than 2 ft. from the floor, and not suitably protecting them in the Brookhill shaft pump-room, on October 12th. Two further charges were preferred as follows:—Contravening special Rule 25 by using electricity with the exposed ends of the cables unprotected and unfinished, and contravening special Rule 34 by the use of electricity without providing an ammeter to indicate the load put on the machine. Mr. W. H. Pickering prosecuted on behalf of the Home Office, and Mr. Maddox (London), instructed by Mr. H. R. Cleaver, defended.

Before proceeding with the case, MR. PICKERING asked for a private conference with the defendants and their solicitors, and then informed the Bench how the charges should be proceeded with. The charges were offences under the Electricity Rules, which should be strictly observed in all mines. He had been assured that everything had now been put right by the colliery company, and that being so, and the defendants at the same time admitting that the rules had been violated, he now proposed to withdraw the charges on payment of costs. In doing this, however, he did not wish to minimise the importance of the special rules which had been violated. The rules in question were now under revision, and would probably be made more stringent. He hoped further that the apparatus complained of would now be made in accordance with the rules, and that the electrical appliances at the colliery would be put in first-class order.

MR. MADDOX said he agreed with what Mr. Pickering had said. It was true that certain complaints were made by the Inspector, and certain things pointed out. An undertaking was given by the colliery company to have the things put right, but considerable delay was caused through not getting goods supplied. When the Inspector came again on October 12th the work was not completed, owing entirely to the firm who had the order for the appliances not delivering. On behalf of the colliery company he now gave an undertaking that all the Inspector's instructions should be carried out.

The MAGISTRATES agreed with the course taken, and granted Mr. Pickering's application to withdraw the charges.

JACOBS *v.* NEWBALD.

IN the City of London Court, on Friday, before Mr. Registrar Wild, a claim was made by Messrs. W. & R. Jacobs, electrical apparatus manufacturers, 39C, King William Street, E.C., against Messrs. E. Newbald & Co., electrical engineers, Court Road, High Street, Sutton, for 17s. 6d. for electrical goods supplied.

MR. STROUTS, solicitor for the plaintiffs, said that the defendants had sent the plaintiffs a cheque for the sum of 15s. 2d., making a deduction of the amount of 2s. 4d. for damaged goods broken in transit. As a matter of fact, he (Mr. Strouts) considered the defendant should have counter-claimed for that amount. There was a notice contained upon the plaintiffs' invoices to the effect that all goods being properly packed, they took no responsibility for breakages in transit. All claims were to be made to the carriers.

In answer to the REGISTRAR, plaintiffs' representative said this was their first transaction.

The defendant, MR. NEWBALD, said they had had lots of previous transactions, but this was the first dispute.

The REGISTRAR: Well, what have you to say to the notice on the invoice?

The DEFENDANT said that upon the arrival of the goods the case was found to be in perfect order. The glass goods inside had

evidently been broken before they were packed. He telephoned to the plaintiffs about the matter at the time. The plaintiffs' traveller, when taking the order, had guaranteed sound delivery. The case arrived in excellent order, and the goods inside were broken without damage to the case. Their point was that they were damaged before they were packed.

MR. STROUTS said that as the case contained glass goods, the contents might very well have become broken by dropping.

The REGISTRAR thought that the onus was upon the plaintiffs to show that the goods were all right before they were packed.

The plaintiffs' WITNESS said that the packer in question could not be called, as he was out of the country.

Eventually judgment was entered for the defendants, an allowance being made for the witness's attendance.

BUSINESS NOTES.

Consular Notes.—Sweden.—H.M. Consul at Stockholm states that Swedish reports continue justifiably to offer congratulations on the success of home efforts in the industries comprised under the title "Machines, instruments and tools." The importation is decreasing, and the exportation increasing, but it will be noted from the returns that Sweden imports annually about £1,000,000 of articles of this denomination, and has continued steadily to do so for some years, except that in 1907, the record year in many ways, a still greater quantity was imported. About one-third of the Swedish exportation of machinery is accounted for by separators, the next leading article being petroleum and benzine motors. Electrical machines find their best market in Norway; other articles of export under this head are oil-cooking stoves, oil lamps, electric lamps, telephone apparatus, surgical instruments, sewing machines, weapons and cycles. This list will indicate that there must be need for a good deal of machinery to be imported, as the Swedish manufacturers seem to cover special patents rather than ordinary machines used in the principal industries. This industry has received considerable attention in the revision of the tariff.

The Vice-Consul at Lulea reports that the scheme for the electrification of the Gellivare-Norwegian Frontier Railway was sanctioned in 1910. It was decided that the Porjus Waterfall, situated at the outlet of the Lake Lulevattnet, should be harnessed for electrical energy to be used for the railway and also for the supply of electrical energy to the mining industries in the neighbourhood. The cost of this construction is calculated at about 9,400,000 kr. (£522,222), and the electrical outfit of the power station at about 2,300,000 kr. (£127,777), or in all a total cost of about 12,000,000 kr. (£666,666.) The work for the erection of this power station is now under progress and is expected to be completed and in working order during 1914. This development must lead to new openings for trade and industries in this part of the country, where industries are likely to be able to obtain abundant convenient working power at a reasonable cost.

The Vice-Consul at Gefle reports that an extensive scheme has been in preparation for some time by the Waterfalls Department of the Swedish State, with a view to the utilisation of the Elfkarleby Waterfalls, about 15 English miles south of Gefle, for the generation of electrical energy. The works were to be begun during the summer of 1911, and it was estimated that power equal to 45,000 H.P. would be made available at a cost of 9,210,000 kronor (£510,000), when the scheme in its entirety had been carried through. It is calculated that the bulk of this energy will be taken up by the various communities and industrial works situated within about 70 miles of the power station, to which distance the power can be economically distributed.

Brazil.—The British Consul at Santa Catharina reports that the State Government has contracted (subject to approval by the State Congress) with a firm of bankers in Paris for the construction of an electric railway, gauge not to be less than 1 metre, starting from the Estreito on the mainland in front of the capital to the city of Lages upon the highlands, about 280 km. from the Estreito, the State paying 40 contos (about £2,666) per km., payable on the delivery of every 40 or 50 km. constructed. Of the above £2,666 about £1,666 is to be paid in State bonds at 84 per cent. net, 5 per cent. interest, and ½ per cent. amortisation, and £1,000 to be paid by the Federal subvention of 15 contos per km., for which the State Government will apply to the Federal Government. On the above basis the company will exploit the line until the bonds issued have been all redeemed. The State concedes also to the company gratuitously three waterfalls which are indicated in the contract, and others that may exist in public lands in the privileged zone, as well as public lands at the minimum price. The plans of the route are to be presented within four months from the date of definite signature of contract, and the construction is to be commenced within the following three months, and to be completed in two years. The engineers have already studied the route.

Russia.—A U.S. Consul at Batum reports to the effect that the Caucasus offers practically a virgin field for the introduction of modern improvements of all kinds. More than three-fourths of the population is engaged in agriculture, but little advantage is taken of modern machinery and implements. The development of public-service properties offers a promising future. There are 15 cities with populations of 20,000 to 50,000, 1 of 80,000, and 3 of over 150,000. These cities will require electric lighting, sewerage, and water systems. Batum has lighting and water plants but lacks proper sewerage, while the city of Baku was authorised in 1910 to contract a loan of $13,905,000 for municipal improvements, including a waterworks and a sewerage system. The work of constructing a stone conduit and collecting station for the waterworks was given to a British firm, at a contract price of about $5,000,000.

The development of mining of all kinds offers a wide range for the sale of appropriate machinery. So far, in the development of mining, preference has been given to no single country in the buying of equipment. The best has been purchased irrespective of its country of origin. The equipment of one big mining property, for instance, includes machinery from the United States, Germany, England, France, and Russia.

"Correspondence with business firms in the Caucasus may be carried on in either French or German. Nearly every firm of importance has in its employ some one understanding one or both of these languages. Catalogues and correspondence in English would have an indifferent reception. Whereas it is probable some attempt would be made to secure a translation of a letter in English, the the ordinary circular or catalogue in the language would be promptly consigned to the waste-basket."

Diesel Engines.—MESSRS. MIRRLEES, BICKERTON AND DAY, LTD., Hazel Grove, Stockport, have recently received, in addition to a large number of orders for these engines for Great Britain, the following for electricity supply stations abroad :—

Australian Commonwealth, for Naval Depôt, Williamstown.—One 40-B.H.P.
Dunedin Corporation, New Zealand.—One 750 and one 500-B.H.P.
Hastings Corporation, New Zealand.—Two 150-B.H.P.
Marine Board of Burnie and Table Cape, Tasmania.—One 50 and one 100-B.H.P.
Queenstown Corporation, South Africa.—Two 85-B.H.P.
Uitenhage Electric Supply Co., South Africa.—One 135-B.H.P.
Wilkie Electricity Works, Canada.—One 100-B.H.P.
Scott Electricity Works, Canada.—One 100-B.H.P.
Secteur Electrique des Ilots de la Seine, Paris.—Three 150-B.H.P.
Jindrichuv-Hrades Corporation, Austria.—One 200 and one 100-B.H.P.
Crown Agents for the Colonies, for Lagos, S. Nigeria.—Two 200 B.H.P.
India Office, for Bombay Dockyard.—One 170-B.H.P.]

Calendars and Catalogues.—MR. C. FRANKLIN TUBBS, of 2, Craven Terrace, Leeds, has prepared for circulation among his friends a small wall thermometer on a hanging celluloid card, which will serve to keep in mind the "Nonpareil" auto-starters and transformers.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—In our reference to list No. 325, *Winkey* leakage indicator was, of course, a mistake for *Winhey*.

We have received from MR. M. H. SMITH, of 4, Racquet Court, Fleet Street, E.C., an electrical advertisers' reference chart which consists of a hanging card whereon appear the names of electrical papers with their day of publication, size of type space, screen for half-tone blocks, and other information. Spaces are left in the table for similar particulars to be entered relating to other papers in which firms may be interested.

MESSRS. RASHLEIGH PHIPPS & CO., 147, Oxford Street, London, W.—Leaflet giving some particulars and prices of cab tire sheathed cables and flexible.

THE EARTH-DRIVEN CLOCK CO., Rowton Buildings, Bowling Green Street, Leicester.—Illustrated pamphlet describing the earth-driven clock, and giving prices of same, and containing a report thereon by Prof. S. P. Thompson.

UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—Advance copy of 12-page pamphlet containing an illustrated description of their D.C. machines with interpoles.

MESSRS. BARKER, SPINK & LEASE, Park Works, Rosse Street, Shipley, Yorks.—Large postal card illustrating a number of their lathes

MR. WM. CROWTHER, 629A, West Derby Road, Tuebrook, Liverpool.—Twelve-page pamphlet entitled "Notes on Drilling," dealing with certain difficulties that arise in electrical workshops, and giving an illustrated description of Crowther's patent reliance drill-grinding jig with instructions for its use.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, Manchester.—New switchgear supply catalogue. The first half of it comprises, in addition to index and discount sheets, a number of sections relating to switchboard assemblies covering the following ground :—D.C. motor panels up to 800 amperes, 650 volts ; A.C. motor panels, ditto ; D.C. generator and A.C. generator panels, ditto ; D.C. and A.C. feeder panels, ditto ; bus-bars and miscellaneous fittings. The remainder of the sections are devoted to the following :—Ironclad air-break switches and fuses and motor control panels ; knife switches ; cartridge fuses and fuse blocks ; porcelain handle fuses ; automatic circuit breakers ; ammeters and voltmeters ; open dial ditto ; moving coil ammeters and voltmeters ; long scale induction instruments ; long scale induction wattmeters ; long scale power factor meters, and rotary synchroscopes. The great feature of this catalogue is the care that has been devoted to arranging the contents in a special way to facilitate the preparation of estimates for switchboards of all sizes and for all purposes. The system must be seen to be fully appreciated. Numerous illustrations and line dimension drawings are included. The lists are all brought together in an expanding binder case.

THE HOYT METAL CO., 26, Billiter Street, London, E.C.—24-page booklet relating to Hoyt's standard Babbitt or anti-friction metals, with a few particulars of tests, and directions for using the metals.

THE BRITISH ALUMINIUM CO. LTD., 109, Queen Victoria Street, London, E.C.—Eight-page illustrated pamphlet relating to aluminium as a material for jigs, the matter being reprinted from an American contemporary.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham. —Mailing card No. 172 illustrates, and states prices of, a small combination electric cooking outfit, specially suitable for small flats, &c. It consists of a 6½-in. boiling plate, with two terminals with a loading of 650 watts, a copper kettle and aluminium frying-pan and saucepan.

THE KNOWLES OXYGEN CO., LTD., Shrubbery Works, Walsall Street, Wolverhampton.—Expanding binder case containing a collection of pamphlets regarding their oxygen, hydrogen and acetylene plants, oxy-acetylene and oxy-hydrogen welding plants, and oxy-hydrogen cutting plants. One of the lists shows the application of the oxy-hydrogen cutters in cutting tram-rails; others describe the Draeger-Wiss oxy-acetylene blow-pipe, the "Lane" acetylene generator, and the "Ideal" acetylene generating plant. A paper by Mr. A. E. Tucker, F.I.C., on "The Influence of Impurities in Oxygen when used for Cutting Iron and Steel," is reprinted, as are also some *Proceedings* of the Municipal Tramways Association bearing on the use of the oxy-hydrogen and oxy-acetylene welding systems for tramway track work.

MESSRS. JAMES NEIL & SONS, LTD., Grange Iron Works, Shettleston, Glasgow.—Several pamphlets have been received relating to Neil's patent rocking bar furnaces for water-tube boilers. One is entitled: "The Twin Nuisance, black smoke and dust from the chimney," and contains coloured drawings showing the application of induced draught with double-rocking fire-bars; another is entitled: "Furnace Efficiency," and is illustrated effectively in colour; and yet another contains "Logical Arguments on Forced Draught." This self-cleaning furnace has, we understand, been extensively adopted, and is in use at many electric light and power stations.

THE PHŒNIX MANUFACTURING CO., LTD., Thornbury Works, Bradford.—Leaflet showing small illustrations indicating the character of the contents covered in the firm's different pamphlets.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—New catalogue of 16 pages giving illustrated particulars of various insulators and insulating material, including some 350 insulators and parts. Prices are stated of a variety of insulators which they carry in stock, to hold one, two, and three wires, and to hold wire from $\frac{1}{16}$ in. diameter up to 3 in. diameter, besides a wide range of leading-in tubes. Messrs. Donovan stock insulators for carrying out installations on the Continental system of wiring with flexible on insulators. Round insulators are listed ranging in diameter from buttons $\frac{5}{8}$ in. diameter to reels 4½ in. diameter. Insulating and jointing material, and other goods required by linesmen, are included. Copies of the catalogue can be obtained on application.

MESSRS. E. BENNIS & CO., LTD., 28, Victoria Street, London, S.W. —Leaflet relating to the economy of small elevators in industrial boiler-houses. A number of half-tone views and line drawings show the applications of Bennis elevators and mechanical stokers in service in connection with boiler-houses. Copies of the leaflet will be sent to any engineer on application.

Callender's Hospital Fund.—The ninth annual report and accounts of Callender's Hospital and Distress Fund were approved at the meeting held at the works on January 20th. Mr. T. O. Callender presided. The report showed that during the year 1911 the Fund subscribed to the hospitals its highest amount since 1905. It referred to the letters issued for out and in-patients at hospitals, for nursing homes, convalescent homes, surgical aid, and so forth. Cases of distress were not so prevalent as hitherto. The 1d. weekly subscription amounted to £219 (the highest since 1905), against £199 in 1910. In addition to a donation of £50 by Callender's Co., and one of £5 5s. from Mr. T. O. Callender, there were seven subscriptions of £2 2s. each from directors and others. The total amount disbursed among hospitals and other institutions was £218, as compared with £194 in 1910. The Committee express a hope that all the members will continue to support the Fund, as most of the benefits it confers cannot be obtained through the new Insurance Act.

Electrical Trades Union.—The Western branch includes among its arrangements evenings devoted to social science subjects and the practical applications of electricity. Such events are held once a month during the winter, beginning in October and ending in April, with a concert here and there as a relief. We are informed that the results are exceedingly pleasing. So far social science has formed the principal subject of the lectures, as members who deliver some of them give electrical subjects second place, arguing that social science is the principal feature of Trade Union education. It is therefore necessary to seek assistance outside, and in this respect the branch has greatly appreciated the help of Messrs A. P. Lundberg & Sons, whose works manager, Mr. G. Pegg, on Tuesday, 16th inst., gave a demonstration of their switches from 28 boards, prefacing it by an historical survey.

Australia.—According to a recent report the Australian Customs authorities have increased the import duty on "Dynamo electrical machines (*a*) up to the capacity of 200 H.P., static transformers and induction coils for all purposes, electric fans," from 20 per cent. to 25 per cent. *ad valorem* under the General Tariff, the preferential rate remaining at 20 per cent. Similarly the duty, under the General Tariff, on "(*b*) Dynamo-electric machines over the capacity of 200 H.P.," has been raised from 12½ per cent. to 17½ per cent. *ad valorem*, the preferential duty remaining at 12½ per cent.

Cable and Wire Manufacturing in Japan.—Our American exchange, the *India-Rubber World*, in the course of a recent article, from a special correspondent, on the "Rubber Industry of Japan," refers to the manufacture of electric wires and cables in the following terms:—

"The Japanese insulated wire and cable companies now number five—the Yokohama Insulated Wire Works, a joint stock company, with a capital of $600,000; the Nippon Electric Wire and Cable Co., a joint stock company, with a capital of $500,000; the Fujikura Cable Works, a joint stock company, with a capital of $500,000; the Sumitomo Electric Wire Department, in Osaka; the Tsuda Co., a limited partnership, with a capital of $10,000, in Kyoto—these factories yearly manufacture insulated wires and cables (except submarine and underground) valued at $5,000,000. The value of imported submarine and underground cables and all other wires and cables is about $1,700,000. The Nippon Electric Wire and Cable Co. manufactures one-fourth of the estimated Japanese production. This company was established at Terashima, Minami-Kazushika-gun, Tokyo, March, 1907, purchasing Mr. T. Komori's electric wire works at the same place. In June, 1910, after passing through financial and technical difficulties, the Furukawa Mining Co. came to its assistance, and Mr. J. Oga took the post of managing director; Mr. T. Komori became manager, and Mr. S. Soki, from Yokohama Insulated Wire Co., became sales agent, Mr. S. Kurozawa becoming engineer-in-charge It is said now that Mr. S. Kurozawa has improved all of the processes, so that the plant is very complete. He studied under the direction of Mr. M. Wachter, an engineer of the Yokohama Insulated Wire Works, and, being possessed of much mechanical ability, is accounted one of the best equipped works managers in Japan. The product of the factory to-day embraces lighting and power cables, insulated wire, rubber and weatherproof, lead-covered and armoured cables, &c.

"The factory is exceedingly well situated on the Sumida River, the grounds being about 3 acres in extent. It is on the railroad and an electric line also runs close to the factory. The motive power is steam. The boilers are Dutch, of the Alban water-tube type, the engine (compound) running at 150 R.P.M. The washers, mixers and calenders were built by Krupp & Co., Germany. The tubing machines came from Germany and the United States. The 500 braiders are from the New England Butt Co. The testing apparatus came from Elliot Bros., England, the saturating tanks from America, the measuring machines from Austria. About 500 hands are employed—300 men and 200 women. The copper wire used is drawn for the company by the Furukawa Mining Co. The customers of the company are the War, Navy and Railroad Departments of Japan, and electric companies in both Japan and China."

Carbons for Spain.—The import of carbons for arc lamps to Spain is continually increasing, and the figures for the first seven months of the year 1911 show a marked increase compared with those during the same period of the previous year. Germany is a long way ahead of the other supplying countries, and France comes second; the total of the latter country for the year 1910 was 20,000 pesetas.

Increased Prices.—MR. W. J. STOKVIS, of Arnhem, Holland, notifies an advance of 5 per cent. in net prices of electric lighting fittings, consequent on the increase in price of metals, &c.

Bankruptcy Proceedings.—CHARLES AUBREY SMITH, electrical engineer, 23, King Street, Regent Street, W., and 6, Granard Road, Wandsworth, Common, S.W.—An application for an order of discharge was made on Tuesday to Mr. Registrar Linklater at the London Bankruptcy Court.—Mr. Egerton A. Grey, Official Receiver, reported that the applicant failed in April, 1904, Mr. R. J. Ward, chartered accountant, being appointed trustee of the estate. The provable debts amounted to £1,085 and the assets, valued by the bankrupt at £777, had realised only £657, out of which dividends aggregating 7s. 10d. in the £ were paid on proofs for £1,085. Upon the death of his father in June, 1901, the bankrupt's mother succeeded to an old established family business of general engineers at 23, King Street, Regent Street, W. It was carried on for three months under the bankrupt's management, and was then handed over to him, with the stock and effects worth about £200. The mother undertook to pay, and did pay, the then existing debts of the business, and as consideration for the transfer of the business, the bankrupt agreed to pay to her £900 out of the proceeds of collection of the book debts then owing, and estimated to produce that figure. He collected from the book debtors, and paid over to his mother £400, and the latter was now a creditor for the balance of £500. The bankrupt continued the business under the old style of "C. J. Smith" until March 29th, 1904, when a judgment creditor issued execution, and sold everything upon the premises, and being unable to collect the balance of the debts of the business to discharge his liabilities, the bankrupt filed his petition. He had since been in employment as an electrical engineer at a salary of about £2 a week; finding his bankruptcy a bar to his advancement, he had induced his mother to provide the costs of his application for discharge, which he otherwise could not afford to pay, and he had acquired no property, and had incurred no debts since the receiving order. His Honour granted a discharge, subject to a judgment for £10. Order entered accordingly.

Social.—On Tuesday, 16th inst., the office staff of the FOSTER ENGINEERING CO., LTD., assisted by members of the engineering works and other departments, gave a concert to which members of the Metal-Filament lamp works were invited. The office had been prettily decorated with bunting and evergreens. The staff and guests present numbered upwards of 150. The

directors, Mr. M. V. Ely (who occupied the chair), Mr. Grote, Mr. E. Dobson and Mr. Lazenby were present; also Mrs. M. V. Ely, Mrs. Grote, and friends, Mr. S. H. Cowen (secretary), Mr. Hill (export and publicity departments), Mr. Delfosse (works superintendent), Mr. Gwyn (superintendent of the lamp works), and other heads of the departments, including Mr. Scott (head of the laboratory). At the conclusion, Mr. M. V. Ely made a short speech, in which he referred to the rapid growth of the company's business and the extension of the works which had already been found necessary, although the company had only built their present works a few months since.

Trade Announcements.—MESSRS. BENJAMIN ELECTRIC, LTD., announce that the word "Luxogen" has been registered as their telegraphic address for their offices and showrooms at 117, Victoria Street, Westminster, S.W.

Owing to the success of the "Venner" patent signs, and the great increase in business in them, the patentee, Mr. R. F. Venner, has decided to take over the entire manufacture himself. While the Credenda Works at Birmingham will continue in full swing, new and separate works will be immediately equipped in London. We are asked to state that in future all communications should be addressed to MESSRS. VENNER & Co., 6, Old Queen Street, Westminster.

The addresses of MESSRS. WARD & GOLDSTONE'S Glasgow and Cardiff branches are as follows:—Baltic Chambers, 50, Wellington Street, Glasgow ('Phone: No. 2355 Central); 4, Church Street, Cardiff.

THE ADAMS MANUFACTURING CO., LTD., ask us to state that they have not appointed sole agents in London for their electrical business, as might be gathered from the note appearing under this heading in our issue of January 12th. Their removal from New Bond Street to Balfour House, Finsbury Pavement, E.C., was largely in order to get into closer touch with their London electrical customers. They have only disposed of the sole selling agency of their motor-car business in London.

Dissolutions and Liquidations.—J. G. CHILDS & CO., LTD., Willesden Green, N.W.—In announcing his intention to apply to the Board of Trade for his release, Mr. H. Brougham, the Official Receiver and Liquidator, says that the Receiver for the debenture-holders, who took possession of all the company's assets in March, 1911, states that there is no prospect of any surplus being ultimately available for the unsecured creditors and shareholders.

THE JOHNSON-LUNDELL ELECTRIC TRACTION CO., LTD.—A meeting of creditors is called for January 29th, at 14, Old Jewry Chambers, London, E.C. Mr. A. E. Messer, liquidator.

ELECTRO-THERAPEUTIC INSTITUTE, 16, Park Place Villas, Maida Hill, London.—H. L. Hart and Bertha Blackith have dissolved partnership. Mr. Hart attends to debts, &c.

REORGANISATION AND CONTROL SYNDICATE, LTD.—A petition presented by a creditor for the winding up of this company is to be heard on January 30th.

JANDUS ARC LAMP (CONTINENTAL PATENTS) AND ELECTRIC CO., LTD.—This company is winding up voluntarily, with Mr. A. A. Gillies, 46, Brown Street, Manchester, as liquidator. A meeting of creditors is called for January 31st, at Manchester. It should be stated that the Continental Co. was formed to acquire the Continental rights only of the original Jandus patents, but there is no connection between this company and the Jandus Co., of Holloway. The latter is in no way affected by the liquidation.

Annual Dinner.—Over 200 ladies and gentlemen, including members of the Marylebone Council, and the entire staff of MESSRS. DUNCAN WATSON & CO., sat down to the annual staff dinner given by Mr. Duncan Watson at Pagani's Restaurant on January 6th. Mr. Cunliffe Owen, secretary of the Metropolitan Electric Supply Co., Ltd., was one of the principal speakers, and he was in reminiscent mood, remembering the days when people were "tumbling over each other to get electric light into their houses." Mr. Rawlinson, one of the oldest members of the staff, proposed the health of the chairman, Mr. Duncan Watson, and presented him, on behalf of the employés, with a pair of silver candlesticks. The chairman, in the course of his reply, referred to his work as a member of the Marylebone Council. Other speakers included Mrs. Courthope Adams and Councillors Helsdon and Fettes.

Electric Laundry on Board Ship.—The laundry on board the ss. *Medina*, in which the King and Queen travelled to and are returning from India, was equipped with ironing machinery by MESSRS. THOS. BRADFORD & CO., the plant consisting of a 90-in. × 24-in. "Decondun" machine for table linen and flat work, and a smaller machine of the "Mirror" type for shirts, collars and cuffs. Both machines were driven by a Witton shunt-wound interpolar motor of 6 B.H.P. at 105 volts, 850 R.P.M., which was fixed inverted to the ceiling, and was controlled by a G.E.C. motor panel fitted with a double automatic starting switch. A similar motor drove the machinery in another room.

Book Notices.—*Ship Wiring and Fitting.* By T. M. Johnson. London: Constable & Co., Ltd. Price 1s. net.—This is a very practical book and contains a large amount of information in a very small compass. It is assumed that the reader has some preliminary knowledge of electricity and some practical acquaintance with the subject. Sea-going engineers will find the book very useful, as it gives just the kind of information which they require in connection with wiring for electric light, bells, telephones and small motors. The book is a handy size for the pocket.

Report on British Standard Heads for Small Screws. London: Crosby Lockwood & Son. Price 2s. 6d. net.—This is Report No. 57 of the Engineering Standards Committee, and contains the recommendations of the Committee for the dimensions of countersunk, instrument, round, cheese and fillister heads for B.A. screws sizes 0 to 14, and for the saw-cuts in the same.

"Boletin de la Sociedad de Fomento Fabril." December 1st, 1911. Santiago de Chile: The Society.

LIGHTING and POWER NOTES.

Argentina.—The Government of the Province of Buenos Ayres has forwarded to the Legislature an *ad* referendum contract, signed with Mr. P. C. Ferreyra, for an electric power house in La Plata for public and private lighting. The contract provides that the Government contract for 100 arc lamps in La Plata, paying $7.85 gold and $7.85 paper per month, the concessionaire to install 500 more at the same price when the Government so decides. The tariff for private lighting and power is to be the same as that charged by the R.P. Electricity Co. In the centre of the city all mains are to be laid underground.

The Buenos Ayres Municipality has signed a new contrrct with the Compania Alemana Transatlantica de Electricidad, for public lighting. The company is to install during the next three years all the arc lamps that may be required, up to the number of 4,000—or more if required—and at its own expense, and supply the current during 15 years at the cost of 4½ cents gold per KW.-hour. The changing of carbons, cleaning of lamps, &c., is to be paid for by the municipality.—*Review of the River Plate.*

Australia.—In connection with the improvement of the lighting of railway carriages, the expenditure of £2,000 has been approved by the Queensland Minister for Railways for fitting electrical equipment into carriages which were, in the first instance, fitted with gas, and which now require renewal. This is in continuation of the policy of carriage lighting laid down some three or four years ago. It has also been decided to install an Edison battery in one of the carriages, in the place of one of the Stone type, which is generally used in Queensland.—*Mining and Engineering Review.*

Aylesbury.—The U.D.C. has decided to apply to the B. of T. for a prov. order for E.L.

Barnsley.—The T.C. has received the sanction of the L.G.B. for a loan of £4,620 for electric light extensions and service mains.

Brighton.—The T.C. has, by 20 votes to 12, declined to adopt an assisted wiring scheme recommended by the Lighting Committee. The objection was on the ground that the scheme would not pay.

Bromley (Kent).—The T.C. has decided to take no steps to resume possession of the electricity undertaking. The period of seven years at which the Council has the power to take over the undertaking expires next March.

Continental Notes.—FRANCE.—The utilisation of water-power for the generation of electricity on the Continent is closely associated with river navigation and similar improvement schemes. The Upper Rhone especially has attracted particular attention, and notably from electricians, as is shown by the projects for the transmission of current mooted in recent times. A new departure of first importance is the formation or a Franco-Swiss Committee, with the object of creating a new river traffic highway between Lyons, Geneva, Constance and Ulm, and thus facilitating communication between Marseilles and Wurtemberg, Bavaria and the Danube countries. If carried out, the scheme will exert an influence favourable to the realisation of many projected electrical schemes.—*La Revue Electrique.*

DENMARK.—The municipal authorities of Struer, Jutland, have decided on the establishment of a central electric lighting station in the town.

BELGIUM.—La Société Centrale Electrique de l'Entre-Sambre et Meuse is the name of a new company which has just been formed at Auvelais, with a capital of £100,000, to acquire and carry on the central electricity generating station at Velaine-sur-Sambre owned by a colliery company, and also the agreements completed with the authorities of 22 small towns and villages in the district with regard to the supply of electricity for lighting and power purposes.

A new company has just been formed in Antwerp, with a capital of £30,000 and the title La Compagnie Electrique d'Anvers et du Limbourg.

Douglas (Isle of Man).—No decision has yet been arrived at by the T.C. with reference to the proposed electricity undertaking. The Manx Electric Railway Co. has approached the Council with reference to a supply of current in bulk, but the Council has deferred action pending further information being obtained.

Dover.—The T.C. has fixed the price of energy for the tramways, after the end of January, at 2½d. per unit.

Erith.—The U.D.C. has agreed to supply current to Messrs. Callenders on the terms that the minimum annual payment for three years shall be not less than the sum represented by £3 16s. per annum per KW. or two-thirds of the total capacity of the Council's transformer plant installed for the purpose of the supply. There is a proviso that the company shall be entitled to a rebate in the event of stoppage of work through strikes, lock-outs, flood, fire, or other similar unpreventable causes.

Falkirk.—The T.C. last week discussed the steps to be taken in opposing the Falkirk and District Electric Lighting order, which is being promoted by Mr. George Balfour. The Council contends that the proposed order will injuriously affect its gas undertaking in Larbert, Stenhousemuir, Carron and Carronshore, and at a private meeting held recently the members decided to adopt every method of opposition to the order, including burgh extension. It was also agreed to take a plebiscite of the ratepayers. At last week's meeting it was decided that a circular be drawn up laying the whole question before the ratepayers.

Fleetwood.—The U.D.C. has decided to submit a petition against the Bill now being promoted in Parliament by the National Electric Construction Co.

Hayle.—On Saturday an accident occurred at the newly-erected electrical power station at Hayle. Sea-borne coal, discharged in the harbour, is transferred in up-to-date mechanical appliances to the station adjoining and there deposited in a store with compartments formed by wooden barriers: with the weight of about 30 tons of coal against it, the partition dividing off the empty section of the store gave way, imprisoning three workmen. Efforts were at once made to remove the coal, and when the men were rescued they were found to have luckily escaped without any serious injuries.

Hornsey.—It has been decided to charge a special rate of 3d. per unit to hospitals in the borough supported by voluntary contributions, on condition that the buildings are entirely lighted by electricity. Instructions have been given to the Parliamentary Committee to take any necessary steps, should it be found desirable, as to lodging a petition against the Bill of the National Electric Construction Co., Ltd.

Irthlingborough.—The U.D.C. has passed a resolution consenting to the prov. order for E.L. being applied for by the Higham Ferrers and Rushden E.L. Co.

Kirkheaton (near Huddersfield).—The U.D.C. has successfully brought to a conclusion the lighting by electricity of the whole of the central district of the village. The current is conveyed from the central station of the Kirkheaton and Lepton Electric Light and Power Supply Co. by overhead wires.

London.—POPLAR.—A loan of £3,965 is to be taken up from the L.C.C. as follows:—Mains, £3,148; plant, £817.

The Charing Cross Co. has intimated that in future in the City area the standard rate for lighting is:—Upper floors, 5d., ground floor, 4½d., basement and external lighting, 3d. per unit; power, heating and cooking, 1½d. per unit. An alternative sliding scale for lighting of 5d. per unit for the first six units per 30 watts of connected demand (each quarter) plus 2d. per unit for further supply, and for power a fixed charge each quarter of 10s. per KW. of connected demand plus 1d. per unit consumed, is provided. For heating and cooking purposes the fixed charge of 10s. per KW. is remitted during the two summer quarters.

North Berwick.—Steps are now being taken for the installation of electric light. Messrs. Crompton & Co. hope shortly to announce the formation of a local company to carry out the work.

Radcliffe.—Among the improvements proposed to be carried out by the Lancashire and Yorkshire Railway Co. at Radcliffe, is a large warehouse provided with modern equipment for the handling of goods, including electrical haulage plant.

Reeth.—The B. of G. has decided to have the Workhouse premises lighted with electricity by Messrs. Burton, of Askrigg, who have carried out the installation for the village.

Stirling.—The Lighting Committee of the T.C. recommends that no action be taken regarding the provisional order applied for by the Scottish Central Electric Power Co. for the generation and sale of electricity in certain portions of the counties of Stirling, Linlithgow and Dumbarton. The area affected does not come nearer to Stirling than the parishes of Denny, Dunipace and Larbert.

The T.C. is to appeal against the poor and school assessment on the electricity undertaking, and to ask for a deduction of 35 per cent. instead of the present deduction of 10 per cent.

Swansea.—The electrical engineer has been instructed to prepare specifications, plans, &c., for carrying out the work of extending the machinery plant, &c., at the generating station and sub-stations, and for new feeder and distributing cables, &c. The cost is put at £45,257, and tenders are to be invited for the carrying out of the work. The borough treasurer reports that in accordance with instructions he has settled the income-tax for 1909-10, with the result that the tax paid on the electric light undertaking had been reduced by £240—this being effected by successfully claiming allowances in respect of depreciation of plant and machinery and rebate on account of current supplied to the Corporation's own departments. The electrical engineer has been instructed to obtain two superheaters for water-tube boilers at a cost not to exceed £250 each.

Tasmania.—The receiving of applications for shares in the Hydro-Electric Power and Metallurgical Co. of Tasmania has closed. As to the work of construction, it is proceeding satisfactorily. Large quantities of machinery and tools have been sent up to the Great Lake and the Ouse, including a complete sawmill, which is to be erected near the power station site.—*Standard.*

U.S.A.—Some time ago the *Electrical World* stated that the newly installed 15,000-KW. turbo-alternator in the Boston Edison station was the largest in New England. That paper pointed out recently that since the Boston unit was installed, the Rhode Island Street Railway Co. has put in operation in its power station, in Providence, a 20,000-KW. unit, which has been in regular service about two months up to the present time.

TRAMWAY and RAILWAY NOTES.

Belfast.—At a meeting of the Law Committee of the Corporation, held last week, instructions were given to the town solicitor to take action to have set aside the second award of the arbitrator, Mr. Macassey, in the matter of the purchase of the Cavehill and Whitewell tramways.

At a special meeting of the same Committee last week, Mr. Nance, general manager, made certain recommendations, including the adoption of a universal 1d. fare, and that 10 per cent. of the excess of revenue over the expenditure be paid to the tramway staff as a bonus. The Committee discussed these and other proposals for some time, and finally adjourned the matter for further consideration at an early date.

Continental Notes.—DENMARK.—The scheme for an electric railway from Aarhus to Randers, previously announced, has met with a series of vicissitudes. The undertaking, when carried out, will unite two of the most prosperous towns of Jutland, besides being the first rural railway constructed in Denmark. It was at first understood that an English company would construct the line, but a visit of inspection made in November last has had for result the withdrawal of its offer. A Swedish company has now come forward—the Allmanna Svenska Elektriska Aktiebolaget—and offers to build a large electricity station for the city of Aarhus and its neighbourhood, and afterwards to mortgage it. The station and entire network are estimated to cost 1,000,000 Danish kroner, which will be provided if the communes interested will give their guarantee. An essential stipulation is that the current for the railway should be drawn from the power station, Aarhus already possessing a municipal station of its own.

Another Danish electric railway is that to connect the port of Köge in the south-eastern portion of Seeland with Taastrup, where a large beet sugar factory, started with German capital, exists, which will provide traffic for the line.

A third Danish electric scheme associated only in the second place with the supply of current for railway working, is that for the building of a power station at Struer, on the island of Jutland. The authorities have decided to build the station at a cost of 150,000 Danish crowns, and to supply current to the State Railways. The station is expected to be completed by October, 1912.—*Elektrotechnik und Maschinenbau.*

ITALY.—La Societa Elettrica Bresciana has secured a concession for the construction and working of an electric tramway between Brescia and Cellatica.

GERMANY.—Plans are being prepared in respect of a proposed electric tramway between Rothenberg and Connern, Saxony.

HOLLAND.—The Rotterdam Tramways Co., of Rotterdam, is in negotiation with the local authorities of Middelbourg, with reference to the supply from its power station of electrical energy for lighting and power purposes in the town.

BELGIUM.—La Société des Tramways Bruxellois has applied for authority to adopt electric traction on its line between Ixelles and the Bourse, Brussels.

AUSTRIA.—The Austrian Government has granted a concession to the A.E.G.-Union Electricity Co. for the electrical equipment of the Austrian section of the Vienna-Pressburg electric railway. The Hungarian section is to be carried out by the Ganz Electricity Co., and the whole of the work is to be completed by the end of this year.

Cowes (I. of W.).—At a meeting of the Council last week, a communication was read from Mr. Adam Scott, of Westminster, inquiring if local support would be forthcoming for any good and cheap project for direct communication between Cowes and Ryde, either by electric tramway or by the railless electric trolley system. The matter was referred to the County Council.

Cowling (Yorks.).—At a meeting of the Parish Council last week a resolution was passed that the Skipton Rural District Council and the West Riding County Council be urged to oppose the Bill which the Keighley Corporation is promoting in Parliament, with regard to the running of railless cars over a portion of the main road in the Cowling district, which would thereby give Keighley a monopoly over the road, and thus prevent the local authority at any future time adopting a similar system over that particular road.

Croydon.—At the last meeting of the County Council it was stated that the takings on the tramways during the last financial year had been £5,119 more than in the previous year.

Dover.—The T.C. has applied to the B. of T. for a loan of £800, for tramway track doubling, &c.

Huddersfield.—The Borough Treasurer's statement respecting the Corporation Tramways for the nine months ended December 30th, 1911, shows that the capital outlay to date is £412,660. The miles run were 1,687,596, compared with 1,540,571 for the corresponding period of the previous year. The income amounts to £80,253, or 11·41d. per car-mile, against £72.993, or 11·37d. for the corresponding nine months of 1910. The total working expenditure is £44,311, or 6·30d., compared with £41,087, or 6·40d. The gross surplus is £35,942, or 5·11d., against £31,906, or 4·97d. Interest on capital absorbs £9,912; redemption of debt, £7,554; and after allowing for depreciation at 3 per cent. (£9,285), there is a net surplus of £9,191, or 1·30d. per car-mile, compared with £4,772, or ·74d. The reserve or renewals accounts amounts to £4,700, compared with £9,959 at the beginning of the nine months.

The application of the tramway men for improved working conditions has been left to a Sub-Committee to deal with.

At a meeting of the T.C. last week, a proposal in favour of railless trolley cars was moved, but was withdrawn after the chairman of the Tramways Committee had stated that the Committee would approve of an application to Parliament for the running of railless cars to outlying districts not served by the present system.

Japan.—Two new lines of electric tramways in Yokohama—known as the Honmoku and Hagoromo lines—have just been opened for traffic by the Yokohama Electric Tramway Co.

London.—A scheme is stated to be on foot to enable the L.C.C. tramway termini to be linked up by omnibuses, in contion with which through fares could be issued, and thus get over the discontinuity of the Council's tramways in North and South London. The L.C.C. already has powers to establish through bookings with the underground electric railways of London, but at present has no powers to enter into any arrangement with the omnibus companies.

Manchester. — Further tramway extensions in the Withington district are contemplated.

Mansfield.—On the electric tramway near Mansfield on Monday, a car crowded with miners on their way to work was nearing the top of Skerry Hill, which has a gradient of 1 in 10, when it stopped and began to run backwards. There was a panic among the passengers, who scrambled off the car at both ends. Two men were injured in a fall. The car ran down the declivity at a great pace, but just before the bottom was reached the brakes began to hold, and the car was pulled up. The manager of the tramways stated that the accident was caused owing to a fuse blowing. The passengers in their excitement rushed to the driver's end, interfering with him, otherwise he could have checked the car much quicker. The brakes were in perfect order.

Port Glasgow.—Messrs. D. & A. Horn Morton have been deputed to report on the cost of putting down electrical plant for the requirements of the town.

Ramsbottom.—A petition has been lodged at the offices of the Ramsbottom D.C. requesting a poll of the electors in respect of a resolution put to a meeting of electors on January 11th, *re* the promotion of a bill in Parliament to enable the U.D.C. of Ramsbottom to install overhead equipment and run trolley cars by railless traction. The requisition is signed by a sufficient number of persons to demand a poll, and arrangements will be made to put the poll into effect. A poll will necessitate considerable expenditure, but the Council has no alternative but to comply therewith. It is to be hoped the result of the poll will be such as to enable the Council to proceed with its project, and thus help to develop the district.

Rawtenstall.—At the T.C., on the 18th inst., it was reported that the B. of T. had written enclosing sanction to the borrowing by the Corporation of the sum of £4,668 to meet excess expenditure in the electrical equipment of the tramway undertaking and the purchase of cars. A Committee was appointed to meet a deputation from the fire brigade with reference to the best method of erecting fire alarm and electric lighting, &c., wires on tramway standards and overhead equipment. It was decided that the engine room at the electricity works be extended, and that a duplicate of the last engine and generator be installed; also that the necessary borrowing powers be obtained.

Stalybridge.—On Tuesday afternoon the employés of the Gas, Sanitary and Highway Departments at Stalybridge came out on strike because six tramwaymen, who had been discharged, were not to be reinstated by the Corporation Tramways Department. About 160 men abstained from work, and as there was not much gas in the gasholders, the outlook was considered serious

U.S.A.—It has been announced officially that the New York, Newhaven and Hartford Railroad will extend its electric zone from Stamford to Newhaven, a distance of 41 miles. Use will be made of the 25-cycle, single-phase overhead catenary contact system operated at 11,000 volts, similar to that now under construction on the Harlem River branch of the road and on the New York, Westchester and Boston line. Work of construction on the overhead system will be begun within the next six months and completed in about one year. For the present and until the line is extended beyond Newhaven all energy for train operation will be supplied from the generating station at Cos Cob. With the extension completed the electric locomotives will cover a total distance of 75 miles between New York and Newhaven, and will completely supersede the steam locomotives for both freight and passenger service throughout this zone.—*Electrical World.*

Worthing.—The T.C., at a special meeting convened for the purpose, has unanimously decided to oppose the Bill being promoted by the Brighton, Hove and Preston Omnibus Co., for powers to run a system of electrically-propelled trolley cars between Brighton and Worthing. Every one of the 23 members in attendance held up their hands for the resolution.

TELEGRAPH and TELEPHONE NOTES.

American Trust Law.—The *Daily Telegraph* financial correspondent states that steps are being taken to secure a Government suit to dissolve the $700,000,000 American Telephone and Telegraph Co., on the ground that it is a combination in restraint of competition, and therefore a violation of the Sherman law.

Cables Interrupted.—On Friday last a steam trawler was wrecked off the Isle of Man, and broke the only cable connecting the island with the mainland.

The Turkish submarine cable between Suakin and Hodeidah has been interrupted, presumably by Italian warships.

Congo State.—The Budget for 1912 includes 40,000 fr. for the erection of telephone lines, and 1,700,000 fr. for the establishment of wireless telegraph stations.—*Board of Trade Journal.*

Effects of the Storm.—The violent wind and snowstorm last week caused much damage to the telegraph and telephone systems throughout the country, with consequent delay in communication. The telephone service especially suffered severely. The telegraph service in the South-Eastern district was seriously disturbed, the wires in that part being more numerous than elsewhere on account of the Continental traffic, and much delay in communication with France and Belgium resulted. The underground lines from London to the chief provincial centres were, of course, immune from damage, and proved their value in maintaining communication without interruption.

Marconi Telegraph Shares.—The *Sunday Times* of January 21st, states that the advance in Marconi shares will be largely based on the success of their subsidiaries, and quotes the Marconi Wireless Telegraph Co., of Canada, with its capital of $5,000,000, in shares of $5, quoted at 18s., as owning stations at Glace Bay with direct communication with Clifden, Ireland, and in Canada 29 coast stations. It states that in Canada it is expensive, and, in places, almost impossible to lay telegraph wires over the prairies of the West, hence wireless has an enormous field, and that is why the Canadian Government is actively assisting the company and granted it an annual subsidy of $60,000 for 20 years. The *Express* for January 23rd, in "Market Gossip," opens out again as to a provisional agreement between the Marconi Wireless Telegraph Co. and the Post Office having been signed, and states that the subsidy to be received will give the shares a value of about £5, as against the present price of 3¾. The *Express* thinks they will reach £7 to £10. It is admitted, however, that there is nothing to go upon at present beyond the market rumours. The chief of these is to the effect that it is in contemplation to provide more adequate telegraphic communication with the British Colonies. This matter was dealt with in our issue of November 3rd.

Turkey.—Reuter states that a convention for the renewal of the Constantinople-Odessa cable concession has been finally signed by the Turkish Minister of Posts and Telegraphs and a representative of the Eastern Telegraph Co. An innovation is introduced permitting of the transmission of telegrams in Russian and Arabic characters between certain centres.

Wireless Telegraphy.—According to the Ges für drahtlose Telegraphie, wireless stations will be erected at Swakopmund, Lüderitz Bay, and Duala in German South-West Africa, the last-named being able to communicate with the station at Togo. This station can also communicate with the station on the Spanish island of Fernando Po. As a central point for East Africa, a station has been set up at Muansa on the Victoria Nyanza.—*Elektr. und Maschinenbau.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—February 13th. 50,000 incandescent lamps and 1,350 opalescent arc lamp globes, for the Melbourne City Council. See "Official Notices" to-day.

March 12th.—Testing instruments, for the P.M.G.'s Department. See "Official Notices" to-day.

Melbourne.—March 5th. Telephone material (Sch. 612); also 120 miles rubber-insulated cotton-covered tinned copper wire (Sch. 594). March 12th.—Instruments (Sch. 639); for Deputy P.M.G., Melbourne.

Tasmania.—February 19th. Wire-testing machine, for the Postmaster-General's Department. See "Official Notices" January 5th.

February 26th. Five miles of cable, for the P.M.G.'s Department. See "Official Notices" to-day.

Austria.—January 29th. The Austrian Post and Telegraph authorities in Vienna are inviting tenders for the supply of 45 tons of copper wire and 70 tons of telegraph cables.

Belfast.—February 12th. One automatic coal weighing machine, and overhead electrical equipment material, for the Corporation. See "Official Notices" to-day.

Belgium.—January 31st. The municipal authorities of the town of Jumet are inviting tenders for the supply of a switchboard for the central electric lighting station.

March 1st.—The Belgian Direction Générale des Ponts et Chaussées in Brussels (38, Rue de Louvain) are inviting tenders for the supply and erection of a 40-ton electric crane at the port of Ostend.

Brussels.—April 10th. Erection and equipment of four new telephone stations, and the supply of switchboards and accessories. Particulars, Bureau des Adjudications, Rue des Augustins, 15, Brussels.

Birkenhead.—January 29th. Stores for a year, for the Corporation electricity and tramway departments. Mr. W. Wyld, borough electrical engineer, Laird Street.

Blackburn.—February 12th. Stores for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" to-day.

Bristol.—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" to-day.

Bulgaria.—Plevna.—Installation of the electric light. £60,000. Guarantee £1,000. Particulars from, and tenders to, the Municipality.

Burton-on-Trent.—January 27th. One 1,250-kw. turbo-alternator, and other electrical and steam plant for the Corporation. See "Official Notices" January 12th.

Croydon.—January 29th. Mixed-pressure turbine plant, for the Corporation. See "Official Notices" January 5th.

Dublin.—January 30th. Dublin Port and Docks Board. Two 4-ton electric portal wharf cranes. Specification, £1 returnable, from Sir J. P. Griffith, Engineer to the Board, East Wall, Dublin.

Epsom.—February 13th. 200-kw. Diesel generator, for the U.D.C. See "Official Notices" to-day.

Exeter.—February 2nd. Vulcanised rubber cables, distribution fuseboards, distribution switch and fuseboard, steel conduits and fittings, for the Visiting Committee of the Asylum. See "Official Notices" January 12th.

Halifax.—February 5th. Stores and materials for a year, for the Corporation Electricity Department. See "Official Notices" January 12th.

February 12th.—Stores and materials required by Tramways Department during year ending March 31st, 1913. Forms of tender, &c., obtainable from the Tramways Engineer, Tramway Offices, Skircoat Road.

Hornsey.—February 7th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" January 19th.

Leeds.—February 14th and 21st. (*a*) 1,000 A.C. meters and (*b*) 40,000 tons of steam coal and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 19th.

London.—L.C.C.—January 30th. Electrical installation at the School of Photo-Engraving and Lithography. See "Official Notices" January 19th.

Stepney.—January 29th. The B.C. is inviting tenders for one E.H.T. converting plant, suitable for 6,000-volt three-phase A.C. to L.T. D.C., together with E.H.T. and L.T. switchgear, &c., for the Limehouse and Whitechapel stations. See "Official Notices" anuary 12th.

Shoreditch.—January 30th. The B.C. is inviting tenders for the conversion into electric motor drive, of a steam-driven deep well pump at Hoxton Public Baths. Specifications and forms of tender from the Superintendent and Engineer, Hoxton Baths, Pitfield Street N. Deposit, £5 (returnable) to be sent with tender.

Bermondsey.—February 19th. Stores for a year for the B.C. Electricity Department. See "Official Notices" to-day.

Manchester.—February 20th. The Corporation Tramways Department is inviting tenders for tramcar-type ampere-hour meters. J. M. McElroy, general manager, 55, Piccadilly, Manchester

New Zealand.—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwts. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

Portugal.—March 2nd. The "Conselho de Administração do Porto de Lisboa," Lisbon, invites tenders for the supply of 10 electric cranes, in accordance with the specifications which may be seen at the offices. For further particulars see this column last week.

Rhyl.—January 31st. 1,700 yards of ·1 overhead feeder cable, for the U.D.C. See "Official Notices" January 19th.

Roumania.—The municipal authorities of Constantza have lately invited tenders for the construction of a central electric lighting station in the town.

Siam.—Bangkok. March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

Southend-on-Sea.—February 7th. The Corporation is inviting tenders for four pier tram trailer cars. Particulars from the Town Clerk.

Tunbridge Wells.—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" January 12th.

Wallasey.—February 12th. One 500-kw. alternator and Diesel engine combined, for the Corporation. See "Official Notices" to-day.

York.—Electric shunting locomotive for the Corporation. See "Official Notices" January 12th.

CLOSED.

Australia.—In last week's list of Sydney contracts, for "The Key Manufacturing Co., Manchester," read "The Key Engineering Co., Ltd., London and Manchester."

Barnsley.—The T.C. has accepted the tender of Messrs. D. Snowden & Sons, Barnsley, for electrical repairs for a year at the hospitals.

Barrow-in-Furness.—The T.C. has accepted the tender of Mr. C. Armstrong-Lamb for the electric light installation at the new fire station, at £124.

Binsley Colliery.—The British Electric Plant Co.'s tender of £305 has been accepted for turbine pump equipment.

Faversham.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for the repair of a dynamo, at £43.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

War Office.

Travelling electric cranes.—Craven Bros., Ltd.
Electric wire.—Hooper's Telegraph and India-Rubber Works, Ltd.
Internal wiring, Louisberg Barracks, Bordon, and Married Quarters, Bordon.—G. E. Taylor & Co.

India Office: Stores Department.

Cable.—Liverpool Electric Cable Co.
Fans.—Veritys, Ltd.
Wireless telegraphy apparatus.—Marconi's Wireless Telegraph Co.

Crown Agents for the Colonies.

Diesel engines.—Mirrlees, Bickerton & Day, Ltd.
Dynamos.—Mather & Platt, Ltd.

Office of Works.

Electric lighting of National Gallery of Scotland.—Wm. Finlay & Co.
Generating sets at Royal Courts of Justice.—J. Howden & Co., Ltd.
Four electric push-button lifts for die and seal department of Royal Mint.—R. Waygood & Co., Ltd.

General Post Office.

Telephonic apparatus, flexible cords.—London Electric Wire Co. and Smiths, Ltd.
I.R. and C.C. cable.—Henley's Telegraph Works Co., Ltd.
Paper-core cable.—Callender's Cable and Construction Co., Ltd.; Johnson and Phillips, Ltd.
Stoneware conduits.—Albion Clay Co., Ltd.
Protectors.—British L.M. Ericsson Manufacturing Co., Ltd.
Electrical equipment, sub-station, Birmingham Head P.O.—British Thomson-Houston Co., Ltd.
Electric lifts, G.P.O. (North) and G.P.O. (West), London, E.C.—A. W. Penrose & Co., Ltd.
Telephone equipment, Finchley Exchange.—Western Electric Co., Ltd.

London.—L.C.C.—The Highways Committee has received the following tenders for electric wiring material required at certain tramway buildings:—

Armordact Manufacturing Co., Ltd.	..	(recommended) £249
Edison & Swan United E. L. Co., Ltd.	..	252
Pinching & Walton	..	254
General Electric Co., Ltd.	..	260

Messrs. Doulton & Co., Ltd., are to supply 400 cream coloured glazed earthenware plough bases at 8s. 6d. each.

Messrs. Newton Chambers & Co., Ltd., are to supply the necessary pipe work in connection with a new coal shoot from the upper coal bunkers above the boilers at Greenwich generating station in substitution for the shoot erected on the outer coal store, at £58.

The Stores and Contracts Committee has placed contracts with the following firms :—

Electric Carbons.—Plutte, Scheele & Co., Ltd., and Sloan Electrical Co., Ltd.

Electric Fittings.—Brotherton Tubes and Conduits, Ltd., Dorman and Smith, Elliott Bros., General Electric Co., Ltd., W. McGeoch and Co., Plutte, Scheele & Co., Ltd., A. Round, Simplex Conduits, Ltd.

POPLAR.—The B.C. is to place an order with Messrs. Willans and Robinson for an additional 3,000-KW. turbine alternator and condenser, at £7,581, less scheduled prices of spare parts.

Swansea.—The tender of the Stirling Boiler Co., Ltd., at £3,508, has been accepted by the T.C. for the supply of two water-tube boilers, mechanical stokers and accessories (except superheaters) for the generating station.

FORTHCOMING EVENTS.

Physical Society.—Friday, January 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Exhibition of a Direct-Reading Instrument for Submarine Cable and other Calculations, by Mr. R. Appleyard; paper on "The Vibration Galvanometer and its Application to Inductance Bridges," by Mr. S. Butterworth; and "Note on a Negative Result connected with Radio-Activity," by Messrs. J. H. Vincent, M.A., and A. Bursill.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 26th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle. Paper on "Motion and Change," by Dr. F. B. Jevons.

Institution of Electrical Engineers (Newcastle Local Section) and Association of Mining Electrical Engineers (North Branch).—Saturday, January 27th. At 7 p.m. At Tilley's Rooms, Newcastle. Smoking concert.

Institution of Electrical Engineers (Manchester Local Section).—Saturday, January 27th. At 7.30 p.m. At the University, Manchester. Meeting with the Manchester Association of Engineers. Paper on "Electrical Furnaces," by Mr. C. Myers.

Institution of Civil Engineers.—Tuesday, January 30th. At 8 p.m. Paper on "The Central Heating and Power Plant of McGill University, Montreal," by Mr R. J. Durley.

Friday, February 2nd.—At 8 p.m. Students' meeting. Paper on "Steam Turbines: Some Practical Applications of Theory," by Capt. H. Riall Sankey.

Institution of Electrical Engineers (London Students).—Wednesday, January 31st. At 7.45 p.m. Paper on "Choice of Material for Overhead Transmission Lines," by Mr. E. V. Pannell.

Royal Society of Arts.—Wednesday, January 31st. At 8 p.m. Paper on "Recent Progress in Radio-Telegraphy," by Mr. G. W. O. Howe.

Northampton Institute Engineering Society.—Thursday, February 1st. Visit to the G.P.O. sub-station, &c.

Friday, February 2nd.—Paper on "Steam Turbines," by Messrs. T. R. Houston and F. G. Parnell.

Royal Institution.—Friday, February 2nd. At 9 p.m. Discourse on "Vital Effects of Radium and other Rays," by Sir J. M. Davidson.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued :—

Monday, January 29th.—"A" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Tuesday, January 30th.—"B" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Thursday, February 1st.—"C" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Friday, February 2nd.—"D" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Saturday, February 3rd.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

Loans for Electric Lighting.—The Local Government Board in its fortieth annual report states that during the last 20 years the following amounts have been sanctioned for the purposes of the Electric Lighting Acts, 1882 :—

1891, £115; 1892, £315,545; 1893, £773,722; 1894, £357,886; 1895, £515,543; 1896, £796,588; 1897, £964,837; 1898, £1,058,164; 1899, £2,390,235; 1900, £3,023,692; 1901, £3,995,459; 1902, £2,736,673; 1903, £1,938,775; 1904, £2,134,623; 1905, £1,058,462; 1906, £802,678; 1907, £1,247,781; 1908, £1,377,268; 1909, £835,068; 1910, £814,746; total, £27,137,680.

The whole of this amount was required by Town Councils and Urban District Councils, with the exception of loans amounting to £20,000, £7,000 and £13,484 sanctioned to be raised by Rural District Councils in 1905, 1908 and 1909 respectively.

ASSOCIATION OF CONSULTING ENGINEERS.

THE official report of the recent meeting of this Association states that it was convened for the purpose of formally receiving the rules which had been drawn up by the committee appointed for this purpose at the opening meeting some 18 months ago. Between 60 and 70 engineers were present, and the chair was taken by Mr. James Swinburne.

The chairman, in opening the proceedings, said that they all knew what the objects of the Association were. The Association should have been launched 50 years ago; in the present state of things, however, it was very difficult to form an Association in such a way as to be satisfactory to everybody. At the same time he was of opinion that if consulting engineers did not take this opportunity of uniting themselves together there was no chance of their ever doing so. It behoved them, therefore, to proceed very carefully and to build on sure foundations.

One of the qualifications for membership in the rules was that the applicant should be a full member of the Institution controlling the branch of engineering in which he practised. It was true that the rules provided that, in addition, members should be of such standing as, in the opinion of the Committee of the Association, entitled them to admission to the Association; but in the initial stage in which they were at the moment (namely, of having formed the Association and appointed the Committee, drawn up rules and received applications for membership, but not having yet actually any members), the Committee were of opinion that it would be wise to adopt some recognised standard of qualifications and to limit the first members to those possessing the qualification of corporate membership of the Institution of Civil Engineers.

This restriction might be criticised by some people, who might say that they were mechanical or electrical engineers and of eminence in their profession, and did not see why the fact that they had not joined the Institution of Civil Engineers should prevent them from joining the Association. On the other hand, it must not be overlooked that the Institution of Civil Engineers was not only the oldest but also the parent engineering institution, and that the majority of consulting engineers already belonged to it in addition to the institutions representing the particular branches in which they practised.

If any competent consulting engineer, who was not a member of the Civils, felt aggrieved that he could not belong to the Association, surely it was not asking a very great deal of him to ask him to join the Civils. If the Association, starting as a young society, could use a body like the Institution of Civil Engineers, which had always been fairly strict in the selection of its candidates and was getting stricter every year, and thus throw the responsibility of deciding as to a candidate's qualifications upon an established institution, leaving the Association merely to decide as to his qualifications in other respects, they were solving one of the greatest difficulties.

Later on, they might find it advisable to make some change, but that was a matter for the future. With regard to the admission of engineers who were receiving a salary and were giving practically the whole of their time to some corporation or some public body, the Committee wished to be logical in carrying out their idea of starting on the narrowest lines, and felt that they should confine the Association initially to those regularly in practice as consulting engineers and having their own separate office and staff.

The Association did not aim at stopping competent consulting engineers who might not join them from doing consulting work, nor did they wish to claim a monopoly. The Committee felt, however, that engineers falling within the class he had outlined were entitled to form an Association which would gradually, through its own standing and character, become recognised as *the* body of consulting engineers.

After the proposed rules had been introduced by Mr. Midgley Taylor and Mr. S. R. Lowcock, a general discussion took place, the speakers being Messrs. B. M. Jenkin, W. Fairley, A. Williams, A. G. Hansard, Cawley, Robert Hammond, E. J. Silcock, H. P. Boulnois, A. S. E. Ackermann, H. P. Raikes, F. W. Hodson, Moss Flower Druitt Halpin and P. Griffiths. The main points to which speakers referred were the scope of the Association, the desirability or otherwise of the membership being restricted to corporate members of the Institution of Civil Engineers, registration of consulting engineers, solicitation of work and the desirability of consulting engineers being free from trading or manufacturing interests.

In conclusion, at the suggestion of Mr. Lomax and Mr. W. Duddell, the chairman put a motion to the meeting to the effect that corporate membership of the Institution of Civil Engineers be a condition of membership of the Association* (with discretionary power to the Committee), and that the Committee have power to elect members from among those who have applied. This motion having been duly carried, the proceedings terminated with a vote of thanks to the chairman. All consulting engineers possessing the necessary qualifications who wish to join the Association should communicate at once with Mr. A. H. Dykes, the honorary secretary, at 11, Victoria Street, Westminster, S.W. This will enable a list of first members to be made without delay. A meeting of members will then be called to ratify the rules and to appoint the Executive Committee.

* Rule 4 (*c*) now reads as follows :—"He shall be a full member of the Institution representing the particular branch of the profession in which he practises and a corporate member of the Institution of Civil Engineers."

NOTES.

Resuscitation from Electric Shock.—The *Electrical World* announces that a Committee has been appointed to carry out a thorough study of methods of resuscitation from electric shock, and to prepare a set of rules for their application. The Committee includes members of the American Medical Association, the National Electric Light Association, and the American Institute of Electrical Engineers. It is suggested that the scope of the inquiry will be made international in character. The rules will be issued by the National Electric Light Association.

Electrical Irrigation.—The *Electrical World* gives a description of an exceptionally large installation of hydro electric power for irrigation at Minidoka, U.S.A. It was laid down by the U.S. Reclamation Service, and raises water to a height of 66 ft. to irrigate an area of 48,000 acres. The plant is driven by water-power, and has a total capacity of 10,000 H.P. in five generating sets, which work at 2,200 volts three-phase; the pressure is transformed to 33,000 volts before reaching the bus-bars, all the switching being done on the E.H.T. side. The cost of the power station (7,000 KW.) was about £12½ per KW. Power is transmitted over 38·4 miles of line to the pumping stations, of which there are three, equipped with turbine pumps driven by 600-H.P. synchronous motors. The latter are provided with squirrel-cage windings to increase the starting torque, and are started up with the fields short-circuited. The output for pumping amounts to 14 million KW.-hours, costing 0·13d. per unit, including depreciation allowance; but if interest and taxes had to be paid, amounting to, say, 10 per cent., the cost would be 0·3d. per unit. The total investment per acre was £3·8, and the total cost of irrigation per acre £0·28. There is also an increasing output for lighting and heating to towns in the district. The efficiency from the water behind the dam to the water pumped is 46·3 per cent.

The National Telephone Arbitration.—The Railway and Canal Commission, consisting of Mr. Justice A. T. Lawrence, the Hon. A. C. Gathorne Hardy and Sir James Woodhouse, sitting in the King's Bench Division on Wednesday, January 24th, heard an application made on behalf of the National Telephone Co. that a date should be fixed for the hearing of the arbitration between the company and the Post Office with respect to subjects transferred from the company to the Post Office, on the value of which the parties could not agree.

Sir Alfred Cripps, K.C., and Mr. H. H. Gaine, appeared for the National Telephone Co.; the Attorney-General (Sir Rufus Isaacs), the Solicitor-General (Sir John Simon), and Mr. Branson for the Post Office.

Sir Alfred Cripps first raised the question of the date of the hearing of the arbitration on the subjects on which the parties disagreed. The undertaking of the company, he said, passed over to the Post Office from the beginning of this year, and he was anxious that the valuation and arbitration should take place as soon as possible. He now suggested that the Court should appoint the first Monday after Easter as a convenient time.

The Attorney-General said his difficulty with the suggestion was that it was premature to fix that date at present. By the agreement, the Post Office had come under certain terms of payment which made it essential that a settlement should be come to as soon as possible, so that they might know what they had to pay. At the same time they were dealing with very huge sums, and it was essential that they should know the particulars before coming into Court, so that they might narrow the issues as far as possible and save a great deal of time. Much of the work could be done out of Court as soon as they had arrived at the real issues between them. It would be better for the present not to fix a date. He did not think it would be possible to deal with the case immediately after Easter. But everything depended on the way in which the case was presented to the Post Office. The inventory had been just about completed, and his friends would know what it was that they were claiming from the Post Office as payment for the plant and undertaking handed over. That was a matter which, no doubt, they could tell him when they came to put their application into writing, and they could also give him some particulars which would be of very great use in respect of the different groups and varieties of plant. If they were to tell him, for example, the number of ducts, there might, or might not, be a question of price arising. What he did want to know, in particular, was the age of the plant, because under the terms on which the Post Office had to make payment, depreciation was an important element, and the plant taken over would have to be assessed at a value dependent on the age and life of the plant. The duration of the life was, of course, a question of opinion, but the age was a question of fact which the applicants would know, and particulars of that kind would be important.

The inventory would be taken by agreement between them. Fortunately, in regard to that there would be very little difficulty between them, but that, of course, was only the material upon which they had to work. The only point was the plant on which they could not come to an agreement. There might be questions which would be left open to the Court, particularly questions of opinion such as the amount to be allowed for depreciation, but he hoped that on many of these they would be able to agree. It was, however, too early to say. The difficulty at present was that they had not the material before them that would enable them to say that there would be only one or two or a certain number of issues for the Court. If they would give him particulars of the nature he had suggested, he could then ask for any further information that he might require, but he did not intend to go through the form of coming before the Court again for that purpose.

Sir Alfred Cripps said that what were known as grouping of class, and variety of class, were already known between them, and he would supply any other information they wanted upon those points. It was not, he said, a question of valuation, but of the agreed inventory which had been arranged between them. With regard to the question of the age of the plant, he thought all the information was already in the possession of the Post Office. But, of course, at any later stage if he could exchange information with the Post Office, he would always be willing to do that, the Post Office giving his clients information on the same heads given to it. He agreed that they should eliminate any issues they could in order to narrow the issue. It appeared to him that all these matters could be perfectly well done so as to enable the case to be heard at the date he had mentioned. As regarded groups, age, &c., if there was any information the Post Office wanted they could have it to-morrow if they wished. A further question that would arise later would be that of the company's tables and the Post Office tables as regarded valuation, but he was willing to exchange the information at any time.

Mr. Justice A. T. Lawrence: Does that mean exchange of inventories, with the prices attached?

Sir Alfred Cripps: Certainly; I am quite willing to put my cards on the table. Let the two parties exchange the whole of the information, then they can see, looking at one another's valuation, what the points are on which they agree. I don't think there will be any friction. The other matter has gone perfectly smoothly, and so, here, we both desire to arrive at a just conclusion, giving the Court as little trouble as possible, and saving the parties as much cost as possible.

Mr. Justice A. T. Lawrence said the Attorney-General seemed to think the date named would not give him sufficient time.

The Attorney-General said his friend had the advantage of knowing his case.

Sir Alfred Cripps said that, outside formal documents, he was willing to give his friend every assistance in real substantial matters.

The Attorney-General: I do want to point out that my friend is coming at this moment to fix a date for hearing, before he has even launched his proceedings.

Mr. Justice Lawrence said that technically that was a difficulty, and out of order. He added, however, that the date was three months hence. If that date were fixed, he said it would leave him two months for dealing with the hearing before going on circuit in June.

Sir James Woodhouse asked how long the hearing was likely to last.

The Attorney-General said it would be impossible to say until they knew how they stood.

Mr. Justice A. T. Lawrence asked Sir Alfred Cripps when he could deliver the particulars desired by the Attorney-General, in respect of groups, varieties, &c.

Sir Alfred Cripps: He can have them at once. When it comes to the question of valuation, another issue arises. We have made a valuation and the Post Office has made a valuation, and we are willing to exchange information on that point.

Mr. Justice A. T. Lawrence: What does the Attorney-General say to that? By this exchange you would be able to investigate the particulars.

The Attorney-General said that depended on the particulars they gave him. If his friend would give him the particulars he was entitled to ask for, so that he might learn what value was attached to one class or another, he might be able to say when he would be ready for the hearing. He said he thought he knew how his friend was going to put his claim, but it was very difficult for him to agree. The matter was one that must have very careful consideration which might possibly lead to a very considerable saving of time. The matter was very easy for his friend, who had his valuation.

Sir Alfred Cripps: And you have yours.

The Attorney-General: That is exactly what I have not. At present I don't know what value I am going to put upon these various classes of plant. Until my friend says what the value of the various classes of plant is, we cannot arrive at a total, which he can do quite easily.

Mr. Justice A. T. Lawrence said if Sir Alfred Cripps said his total claim was so much and his claim for each variety so much, the Attorney-General could agree to so many and disagree with so many others. Sir Alfred's suggestion then was that they should exchange figures on the varieties on which they disagreed, and the Attorney-General's position was that he would not be in a position to do so unless those who instructed him had made some estimate. (Addressing the Attorney-General) "If they give you their particulars within a fortnight, could you say when you would be ready? What I want is to keep these two months available for you to deal with this matter."

The Attorney-General said he would have no objection to the suggested date being provisionally reserved, but he objected to having it fixed, because that would put upon him the burden of coming again to the Court if he could not be ready on that date. That was a position in which he did not want to be placed. He thought he was entitled to look for some little proof of the friendliness professed before consenting to fix a date.

Sir Alfred Cripps said he believed if the appointment were made it would make both parties anxious to have their case ready by that time, and if, for any good reason, that could not be done, the Court would always assent to an application to postpone the hearing. He stated that his clients knew, broadly, some of the valuations made by the Post Office, which were so far apart from their

own that there was no chance of an agreement being reached, and the decision of the Court would have to be taken.

After some further discussion, the President suggested that, as the Court would be sitting again on March 25th, the case might be adjourned to that date, when the parties might be prepared to say whether they would be ready by April. That, he said, would give an opportunity for the Attorney-General to consider whether he could fall in with Sir Alfred Cripps's suggestion to exchange figures in cases where they differed. It was quite certain that in adopting that course the Attorney-General would be giving up certain of his technical rights, but, on the other hand, in a huge matter of this sort, the saving would be probably quite as much as by following the more technical way of dealing with the matter.

The Attorney-General: I quite agree. It may save a good deal of trouble.

Sir Alfred Cripps said the information he proposed to give by way of exchange was such as could not be obtained under any procedure.

The application was, therefore, adjourned until March 25th.

Why the Meter would not Mete.—Electricity meters have been subjected to an amount of suspicion which is not altogether warranted by the number of times that they have actually failed to give the exact registration of energy consumed. Possibly this is due to the fact that they are associated in the mind of the public, which has a tendency to generalise, with their distant relation, the gas meter. Whatever may be the reason, however, the consumer who is called upon to pay his lighting or power account has an irritating tendency in the direction of ringing up the supply station and demanding in pungent language the instant examination of the meter on his premises. Sometimes, however, the boot is on the other foot. The consumer pays his bill with a serenely happy smile, and the electricity supply authority is casting about for an adequate reason why such and such an account should be a diminishing quantity. The meter again is the object of suspicion, and sometimes these suspicions are well founded.

The reason is, however, not always a technical one. Without referring to ingenious methods of influencing the incorruptibility of the meter or of by-passing the current by means of unostentatious pins stuck through the insulation of the leads, there sometimes arise cases which look like a special interposition of Providence on behalf of the consumer. In one instance, an electricity supply was taken for lighting purposes by an establishment devoted to the process of converting cattle hides into leather, and the electricity staff used to say that if anything was worse than the local perfume, it was the swarm of blue bottles and other flies which infested the place during the larger part of the year. This, however, did not interfere with the electricity supply until on one occasion the meter reader found that the demand for light during the quarter had come down very considerably. This was noted again in the succeeding quarter, and the supply authority thought that the time had then arrived to make investigation as to the reliability of the meter. It was, therefore, replaced by another one and the old one was taken to the works for overhaul. It was found that the series and shunt connections were all right, but that the disk of the meter seemed to move with a certain amount of friction, and this led the inspector to examine the interior of the meter by the aid of a strong local light. After poking about around the disk with a small piece of stick, he found out the cause of sluggishness on the part of the meter, inasmuch as he dug out from between the disk and the pole piece adjacent to it a beautifully preserved specimen of the blue bottle. This had evidently pitched on the disk, and having been carried round by the rotation got itself jammed between the pole piece and the disk, and it had then given up the ghost. The question, however, that has agitated the minds of the meter staff ever since is this: Seeing that the case of the meter was hermetically sealed, how did that fly get into the meter?

Hardanger Electrical Iron and Steel Works.—At a general meeting of the company on the 11th inst. the manager of the works, Engineer A. Hartmann, gave the following information as to the working of the electrical process:—Operations were started early in November, the charges employed have been comparatively poor as regards their content of iron. This is due to the fact that the roasting oven of the works has not been completed as yet, and will not be ready for use before February, for which reason the available ore has not been subjected to the proper pretreatment. The results obtained have, however, been just as successful as those which were achieved at the Trollhättan experimental works in Sweden with charges of a corresponding quality, and the process being the same, this proves that the anticipated results have not been too optimistic. As soon as the roasting oven is completed, the work will be carried on with full speed, and richer charges will be used. This will increase the output considerably, and there is no reason to doubt that the same results as at Trollhättan will be obtained, and even improved upon. The prices which have been obtained for the products up to the present are very favourable, and the anticipated reduction in the cost of production, or rather the improved quality of the products, will, of course, exercise a beneficial effect in favour of the new enterprise.

New Electrical Ironworks in Norway.—A new company, which owns iron deposits in Nordland, just within the Arctic Circle, has submitted an application to the Melöy parish with the view of acquiring the Sykan waterfall in the Glomsfjord. The river in question comes from the large glacier "Svartisen." The company intends to harness the Sykenfas, and by means of the energy derived from it, to start the electrical smelting of iron ore on a large scale. The water will pass through two tunnels, and will have a head of nearly 440 yards. It is reported that a sum of nearly £400,000 will be spent on the plant and the necessary works in connection with the enterprise.

Institution and Lecture Notes.—By the courtesy of the Liverpool University Authorities and Prof. Marchant, members of the Engineering Society attached to the Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, were present on Friday evening at a very interesting invitation lecture on "The Generation and Transmission of Electrical Energy." In spite of the bad weather the meeting was well attended. Prof. Marchant showed a most interesting series of slides depicting hydro-electric installations in America and elsewhere, and further illustrated his lecture with some experiments demonstrating fundamental electrical principles.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).—The annual smoking concert of this Section is to take place at the Grosvenor, Glasgow, on Saturday, February 10th.

INSTITUTION OF ELECTRICAL ENGINEERS.—Our Bath correspondent states that the time has been thought opportune to inaugurate a new Local Section of the Institution extending over the counties of Somerset, Gloucestershire, Wilts, Dorset, Devon and Cornwall, and on the other side of the Channel, taking in that part of South Wales extending down to the neighbourhood of Swansea. A canvass of members of the profession has been made, and it has been ascertained that there is a practically unanimous desire to see the scheme adopted. Arrangements are being considered for the inaugural meeting, and this, it is expected, will take place towards the end of February, in Bristol, under the chairmanship of Mr. S. Z. de Ferranti, the president. A dinner will follow the meeting. The fact that there are upwards of 200 members of the Institution within the area covered by the Western Section should ensure a strong organisation from the outset.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—On Tuesday a paper by Mr. H. A. Mavor on the screw propeller was to be discussed by the Institute. There appears to be no limit to the departments of engineering into which the electrical engineer is compelled to pursue his investigations, while developing new applications for his own science.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS (NEWCASTLE BRANCH).—A lecture by Dr. W. M. Thornton, on the "Use of Electricity in Coal Mines," was delivered at the Eldon Colliery Institute, on Wednesday, January 24th.

BIRMINGHAM AND MIDLAND INSTITUTE.—A successful conversazione was held on January 9th-12th, and was attended by no fewer than 5,120 persons. A variety of exhibitions was arranged, and music, dancing and lectures were included in the programme.

NORTHAMPTON INSTITUTE ENGINEERING SOCIETY.—On January 19th Mr. W. A. Hislop read a paper on "Reinforced Concrete Construction" before the above Society.

THE CONCRETE INSTITUTE.—An interim report has been issued on the consistency of concrete, with a number of replies received from correspondents on the subject.

A Chinese Cotton Mill.—U.S. Consul-General Wilder, of Shanghai, in a recent report, says that a new mill has been completed in Shanghai by the Japanese Naigai Wata Kaisha for spinning cotton yarn. The mill is distinctive as the only one in China whose machinery is operated by electricity generated on the premises and supplied direct from the dynamos in the engine house to the plant in its various departments. The site includes about 9 acres of ground on Soochow Creek. The plant has been three years in course of construction. A feature is the water tower, surmounted by a reinforced concrete tank 60 ft. above the level of the ground and with a capacity of 12,000 gallons. Residential quarters are near by for the heads of departments. The mill hands are housed in a series of one-storey buildings. There are three main B. & W. water-tube boilers, fitted with automatic chain stokers, feeding Japanese fine coal. The main power is generated in the house adjoining by two Belliss & Morcom triple-expansion engines, driving two Siemens direct-current dynamos, each capable of developing 600 KW. The engines rest on a solid foundation of reinforced concrete 40 ft. thick, 25 ft. of which is below the surface of the ground. In the factory proper there is space for 40,000 spindles, 20,000 of which are now running, 16s yarn being a speciality. The spinning machinery is all by Platt Bros., of Oldham. The entire establishment is provided with a complete equipment of patent sprinklers. At present there are 300 women operatives and 150 men employed, with Japanese foremen, fitters, and overseers at the heads of the departments; 90 per cent. of the cotton handled is of local native growth and 10 per cent. is Indian. The company also owns two mills in Japan, one at Osaka and the other at Nishinomiya.

State Monopoly of Electrical Enterprises in Uruguay.—The Government of Uruguay has recently submitted to the Second Chamber a Bill authorising the Government to acquire all the electrical works of the towns and villages in the country, with the view of creating a State monopoly for this industry. The Bill further authorises the Government to issue bonds for 4½ millions Uruguay gold dollars, which are to be at the Government's disposal for the erection of new electrical works for power and lighting purposes in places where there are no such works as yet.

As a compensation to the town of Monte Video for the acquisition of the municipal electrical works, the Government will take over the responsibility in connection with the so-called Baring Loan

of Monte Video, the amortisation and interest of which represents an annual expenditure of $360,000. This amount, which is thus liberated, will be spent on various improvements in the town.—*Buenos Ayres Trade Journal.*

The Association of Consulting Engineers.—From among the various criticisms that have appeared in the technical Press regarding the intentions of those interested in this movement, we select for reproduction the following editorial view expressed in the *Times Engineering Supplement* on Wednesday, January 24th:—

"The official account of the proceedings at the inaugural meeting of the Association of Consulting Engineers contains what may be assumed to be a fairly full report of the opening remarks of the chairman, Mr. James Swinburne, but it is singularly lacking in detail and information as to the discussion that took place afterwards. Mr. Swinburne admitted that the inauguration was half a century later than it should have been, and the general impression conveyed by the report is that its birth and baptism might have been delayed for another 50 years without serious detriment to the welfare of the profession or the happiness of nations. It was recognised by the chairman that all applicants for admission into the Association should be full members of the Institution controlling the branch of engineering in which they practise, and it was further insisted that in addition they should, at least to begin with, belong to the Institution of Civil Engineers. This device, of course, saves the Association all expense, and most of the responsibility involved in the examination and selection of candidates, and leaves it merely the pleasant task of placing the crowning glory upon the heads of those whom it deems worthy to pass into the full blaze of notoriety as consulting engineers. It does not seem to occur to the chairman that the greater includes the less. An engineer who has been duly elected by the Council of his specialist institution into the full fellowship of his specialist branch, and who has moreover had bestowed upon him the diploma of the Institution of Civil Engineers by its honoured Council, has all he wants. To submit himself to further analysis by the Council of a lesser body is of no advantage either to himself or to that Council. In other words the Association seeks to paint the lily. The situation is not devoid of humour, and, as usual, it has arisen from a misconception of the scope and definition of the word 'consulting' as applied to engineers. There is no added virtue or qualification necessary for a qualified engineer to take up consulting work. In a certain sense, all qualified engineers are consultants, whether their functions are fulfilled in India, Egypt, Crewe, Chatham, or Victoria Street."

Appointments Vacant.—Assistant installation inspector, for the Shanghai Municipal Council (£25 per month); charge engineer, for the Newport Corporation Electricity Works (£2); assistant electrical engineer for the Bispham-with-Norbreck U.D.C. (25s.—30s.); shift engineer for the Rawtenstall Corporation Electricity Department (30s.). See our advertisement pages to-day.

Room for Improvement.—A correspondent sends the following cutting from the Manchester *Evening Chronicle*:—

> Vacancy for Improver in Electricity Supply Station, near Manchester; salary 5s. per week to commence; good prospects for suitable man.

Granted that an "Improver" can hardly expect a "living wage," as his labour is largely given in payment for the opportunity of acquiring knowledge and experience in his calling, still he is entitled to expect a good deal more than the pay of a young apprentice. Is the 5s. a misprint for 15s.? Anything less would be justly called a sweating rate.

An Electric Light Rescue.—The master of a hopper barge having fallen overboard in the Thames, an apprentice named Pusey jumped in to the rescue, with an electric torch; supporting the master with the aid of a lifebuoy, Pusey flashed his torch to guide others to the spot. Last week he received the award of the Royal Humane Society for his pluck and resource.

The Electrical Industry in the U.S.A. — Some interesting figures are given in a review of last year's results in the *Electrical World* of January 6th, and are reproduced below:—

	1910.	1911.
Electrical apparatus made	$300,000,000	$325,000,000
Electric railway earnings	520,000,000	575,000,000
Central station sale of energy, &c. ...	300,000,000	375,000,000
Telephone earnings	275,000,000	310,000,000
Telegraph earnings	65,000,000	75,000,000
Isolated plant service	100,000,000	125,000,000
Miscellaneous electric service ...	75,000,000	100,000,000
	$1,635,000,000	$1,885,000,000

Yet, in spite of these remarkable returns, our contemporary speaks of 1911 as undoubtedly "a rather dull, off year, when little business, not less than 'big,' has been checked in a season of depression."

A financial authority is quoted in respect of six properties in the electric railway field, which in four years up to December 31st, 1910, show gains of 70 per cent. in gross earnings, 166 per cent. in dividends, and 140 per cent. in reserves and surplus. Another publication charts the gross and net earnings of electric railway, electric light and gas properties, as compared with other industrials, and shows not only a general absence of disturbing effect on electricals from the panic and depressed periods of the last five years, but an upward trend of the curves that is almost startling in its persistent ascension. Our contemporary concludes that there is every reason to believe that in 1912 the electrical arts will be giving a service far in excess of $2,000,000,000, a fair profit on which will mean greater prosperity than the industry has ever enjoyed before. We can well believe it: would that similar figures could be shown for the industry in this country.

It is interesting to note, too, that in North America there are 6,300 central stations, of which 85 per cent. serve communities of less than 5,000 residents.

Concerts.—The second annual Siemens Supplies smoking concert is to be held in the Pillar Hall, Cannon Street Hotel, E.C., on February 2nd.

On Friday evening last, the Faraday House Old Students' Association held their smoking concert. Mr. H. H. Perry, M.I.R.E., President of the Association, was in the chair. The programme was under the direction of Mr. H. H. Heap.

International Congress of Applied Chemistry, 1912.—For the interest of prospective authors of contributions to this Congress there have been issued printed rules on papers, their presentation, discussion and publication. The Congress takes place at Washington and New York in September next. Mr. B. C. Hesse, 25, Broad Street, New York City, is the Secretary.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At a smoking concert held at the Rawson Hotel, Bradford, on Friday last, a presentation was made on behalf of the staff and employés of the Bradford Corporation electricity department, to Mr. H. S. ELLIS, on the occasion of his vacating the post of deputy city electrical engineer and manager in Bradford, to take up the position of borough electrical engineer at South Shields. In making the presentation, which consisted of a solid silver cigarette-box, cigarette-case, and a match-box, Mr. T. Roles, city electrical engineer, paid a tribute to the able manner in which Mr. Ellis had carried out his duties in Bradford, and wished him every success in his new sphere of labour. Alderman G. H. Robinson, chairman of the Electricity Committee, expressed on behalf of the Committee their appreciation of Mr. Ellis's services. The following members of the staff representing the various departments also testified to the good feeling which had always existed between them and Mr. Ellis, and to his never-failing courtesy towards them on all occasions:—Mr. J. H. Schnauber, deputy engineer: Mr. J. Fairbairn, deputy works superintendent; Mr. C. R. Brown, generating engineer; Mr. J. E. Albrow and Mr. C. A. Gillin, mains department; and Mr. C. B. Holdsworth, secretary. Mr. Roles made apologies for the absence of Councillor Jas. Hustler, deputy-chairman of the Committee, who had a prior engagement, also for Mr. Wm. Jones, works superintendent, who is away recuperating after a long illness, and for Mr. C. E. Allsopp, consumers' superintendent. The opportunity was also taken by Mr. Dadge, electrical engineer to the Bradford Dyers' Association, Ltd., to hand to Mr. Ellis, on behalf of the staff of his department, a pair of silver vases, as a mark of the esteem in which Mr. Ellis was held by them. Mr. Ellis, in acknowledging the presents, expressed his appreciation of the kindness and assistance he had received at the hands of all he had come into contact with during his five years' association with the electricity department of the Bradford Corporation. A capital programme of humorous and musical items was sustained by members of the Corporation staff and the B.D.A. staff.

MR. F. H. EDWARDS, late deputy electrical engineer to the Erith Council was on 16th inst. the recipient of a gold albert, together with a slide rule, presented by the members of the Council's staff, on the occasion of his leaving Erith to take up his new duties as chief electrical engineer to the Cornwall Electric Supply Co. at their Hayle power station. The presentation was made by Mr. Arthur Coveney, the electrical engineer and tramways manager. Mr. Edwards returned thanks in a few appropriate remarks. Tributes to his quality and the esteem in which he was held by his old colleagues were also paid by Mr. W. E. Deighton, of the electricity and tramways department; Mr. W. Barton Young, librarian; and Mr. J. Custance, of the surveyor's department. The subscribers, who attended to the number of 50, were accommodated in the Lecture Room of the Public Library.

The Poplar B.C. has decided to grant increases of salary to the following officials in the electricity department:—MR. W. INNES, assistant engineer, £265 increased to £277 10s. per annum; MR. E. R. INGRAM, mains superintendent, £185 increased to £197 10s. per annum.

The Aberdare U.D.C. has appointed MR. W. T. HILDER, shift engineer, as mains superintendent.

The Burton-on-Trent T.C. has increased the salary of the electrical engineer, MR. T. HALL from £200 to £225 per annum.

General.—The Leicester Education Committee have increased the salary of MR. A. E. CLAYTON, instructor in electrical engineering at the Technical Schools, from £160 to £170 per annum.

The *Review of the River Plate*, of December 29th, says:—"Engineer MAURO HERLITZKA has left for Europe on a business trip in connection with the various electrical companies in which he is interested."

MR. HUGH ROSE, foreman electrician, Locomotive Works, Inverurie, has been appointed engineer at Dunecht House, to Lord and Lady Cowdray. Mr. Rose, who has been in the service of the railway company for a long period, has had charge of the power and lighting at the Inverurie Works for the past six months. He has also had charge of the installation at the Palace and Cruden Bay Hotels.

General regret is felt in Huddersfield at the resignation from the Town Council of ALDERMAN ANDREW CHATTERTON, chairman of the Electricity Committee, and at a meeting of the Corporation last week, high appreciation was expressed of Mr. Chatterton's services during the 11 years he has been a member of the Council.

With reference to the dissolution of partnership of MESSRS. HOOGHWINKEL & THURSFIELD, consulting engineers, of Leeds and London, Mr. F. Thursfield is joining the staff of Messrs. Balfour, Beattie & Co., and his address, after February 1st, will be 22A, College Hill, Cannon Street, London, E.C.

We regret to learn that a note appearing under this heading in our issue of December 1st, 1911, is in some respects inaccurate. We now understand that MR. JENSEN was not assistant electrical inspector, but was a temporary assistant engineer engaged specially for the Durbar work. The resignation of MR. J. S. PITKEATHLY, the electrical inspector to the United Provinces, was in no way connected with the salaries of the Royal Engineer officers. These officers were appointed by the Government of India at Mr. Pitkeathly's own request to assist him in the Durbar electric lighting work, and his relations with them were pleasurable throughout. As long ago as last July, Mr. Pitkeathly asked the Government of the United Provinces to accept his resignation from the end of the Durbar.

Obituary.—MR. W. HAYNES, J.P.—The death occurred on Sunday of MR. WM. HAYNES, J.P., head of the firm of Haynes Bros., Ltd., electricians, Gabriel's Hill, Maidstone. Deceased, who was found dead in bed, was a former Mayor of Maidstone, a Justice of the Peace for the borough, and last June received the Honorary Freedom of the borough.

NEW COMPANIES REGISTERED.

Tramways (M.E.T.) Omnibus Co., Ltd. (119,684).—This company was registered on January 13th, with a capital of £200,000 in £1 shares, to carry on the business of omnibus, van, motor-car and cab proprietors, carriers of passengers, parcels, goods and mails, motor and electrical engineers, contractors, &c., and to enter into contracts with the Metropolitan Electric Tramways, Ltd., and others. The subscribers (with one share each) are:—J. J. Gibbons, 5A, Lyric Road, Barnes, S.W., clerk; H. Munro, 6, Connaught Avenue, Chingford, clerk; J. McLeod, Canonbie Road, Honor Oak, S.E., accountant; A. O. Ingram, The Beeches, Carshalton, clerk; P. A. Godfrey, 24, Nanford Road, Upper Clapton, registrar; E. Boys, 74, Cromford Road, East Putney, S.W., secretary; T. Bower, 1, Kingsway, W.C., secretary. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £250; remuneration, £100 (chairman, £100 extra). Registered office, Electrical Federation Offices, 1, Kingsway, W.C.

Telephone Duplicating Recorder Co., Ltd. (119,644).—This company was registered on January 11th, with a capital of £200 in 195 pref. shares of £1 each and 100 ordinary shares of 1s. each, to acquire any existing agency, business or undertaking now engaged in the purchase and resale of an instrument or apparatus commonly known as "Gamble's Duplicating Telephone Recorder," and the purchase and resale of paper refills used in connection therewith. The subscribers (with one preference share each) are:—T. K. Irwin, 5, London Wall Buildings, E.C., engineer; G. F. Fergusson, 5, London Wall Buildings, E.C., merchant. Private company. The number of directors is not to be less than two; the subscribers are to appoint the first. G. F. Fergusson is the first secretary. Registered offices, 5, London Wall Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594).—Issue on December 15th, 1911, of £200 debentures, part of a series of which particulars have already been filed.

Willans & Robinson, Ltd. (40,660).—Debenture dated December 20th, 1911, to secure £40,000, charged on the company's undertaking and property, present and future, including uncalled capital, subject to indenture of mortgage and trust as regards certain freeholds and leaseholds. Holders: G. H. D. Coates, Rugby; and W. C. Buckley, Eden Place, Edmund Street, Birmingham.

Bankfoot Power Co., Ltd. (98,134).—Issue on December 23rd, of £22,300 debentures, part of a series of which particulars have already been filed.

C. F. Casella & Co., Ltd. (106,869).—Issue on December 18th, 1911, of £50 debentures, part of a series of which particulars have already been filed.

Evershed & Vignoles, Ltd. (43,266).—Particulars of £15,000 debentures, created December 6th, 1911, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £12,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, and land and buildings at Acton Green. Trustees: London County and Westminster Bank, Ltd.

Middleton Electric Traction Co., Ltd. (68,935).—Particulars of £9,000 debentures, created December 19th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd. (107,947).—Trust deed dated December 13th, 1911, supplemental to trust deed dated June 14th, 1910, to secure £35,000 debenture stock, ranking *pari passu* with £80,000 debenture stock secured by principal deed, charged on various premises. Trustees: Right Hon. Lord Waleran, P.C., 44, Hans Mansions, S.W.; and Right Hon. Lord Rotherham, 61, Queen's Gate, W.

Egham and Staines Electricity Co., Ltd. (99,625).—Particulars of £5,000 debentures, created February 22nd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

South American Light and Power Co., Ltd. (74,446).—Particulars of £150,000 debentures, created October 5th, and secured by trust deed dated December 7th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Premier Investment Co., Ltd., 9, New Broad Street, E.C.

Midget Electric Lamp Manufacturing Co., Ltd. (114,092).—Debenture dated December 30th, 1911, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Turner, jnr., Shepherd's Bush, W.

Thomas Kesnor & Co., Ltd. (100,419).—Mortgage on certain land and buildings in Watford, dated December 28th, 1911, to secure all moneys due or to become due from the company to the London and South-Western Bank, Ltd., 170, Fenchurch Street, E.C. Also mortgage dated December 29th, 1911, to secure £260, charged on same property. Holders: W. Judge and G. A. Judge, Watford.

Reason Manufacturing Co., Ltd. (64,701).—Mortgage dated December 29th, 1911, to secure £1,000 and any other present or future indebtedness, charged on present and future indebtedness of Corporation of Stepney. Holders: Barclay & Co., Ltd., 54, Lombard Street, E.C.

Hong Kong Tramway Co., Ltd. (75,486).—Mortgage dated November 30th, 1911, executed in Ceylon and supplemental to trust deed dated July 1st, 1908, securing £195,000 debentures, charged on certain land and premises in Hong Kong. Trustees: Consolidated Trust, Ltd., Dashwood House, New Broad Street, E.C.

Oswestry Electric Lighting and Power Co., Ltd. (38,303).—Particulars of £1,500 debentures, created July 1st, 1910, filed pursuant to Sec. 93 (3) of Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's property, present and future, including uncalled capital, but excluding book debts due to company for current supplies, subject to any legal priority attaching to the security already given to Parr's Bank, Ltd., to secure advance made by them. No trustees.

Engineering Instruments, Ltd. (66,427).—A memorandum of satisfaction in full on January 13th, 1912, of debentures dated from December 20th, 1906, to April 27th, 1909, securing £3,480, has been filed.

Globe Electric Co., Ltd. (102,289).—Particulars of £1,000 debentures, and £1,000 second debentures, created December 30th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amounts being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd. (75,139).—Issue on January 15th, 1912, of £163 10s. debentures, part of a series of which particulars have already been filed.

Corona Lamp Works, Ltd. (116,527).—Particulars of £20,000 debentures, created January 9th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,800. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A memorandum of satisfaction in full in January, 1912, of debentures dated July 10th, August 22nd, September 13th, October 10th, and November 9th and 21st, 1911, securing £2,000, has been filed.

Woking Electric Supply Co., Ltd. (46,175).—Issue on December 5th, 1911, of £1,400 debentures, part of a series of which particulars have already been filed.

Frinton-on-Sea and District Electric Light and Power Co., Ltd. (70,689).—Particulars of £3,000 debentures, created October 26th, 1905, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £400. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first debentures. No trustees.

Electrical Power Storage Co., Ltd. (30,313c).—Particulars of £30,000 debentures, created February 14th, 1907, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ackroyd & Best, Ltd. (54,600).—Issue on December 8th, 1911, of £6,700 debentures, part of a series of which particulars have already been filed.

General Electric Co., Ltd.—A statement of the total amount outstanding on July 1st, 1908, in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: First mortgage, dated 1900, securing £200,000 first mortgage debenture stock.

Consolidated Signal Co., Ltd. (71,141). (Formerly known as Pneumatic Electric and General Engineering Co., Ltd.)—Return dated November 23rd, 1911. Capital, £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. 214,195 preference and 150,548 ordinary shares taken up. £1 per share called up on 24,999 preference and 27,840 ordinary. £52,889 paid. £311,904 considered as paid on 189,196 preference and 122,708 ordinary. Mortgages and charges: Nil.

G. C. Milnes Voss & Co., Ltd. (89,352).—A memorandum of satisfaction to the extent of £1,700 on November 30th, 1911, of debenture dated December 14th and Equitable charge dated December 15th, 1910, securing £1,950, has been filed. (The Equitable charge has been discharged.)

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—Return dated October 10th, filed October 19th, 1911. Capital, £50,000 in 10s. shares (37,500 "A" and 12,500 "B"). 42,297 "A" and 12,500 "B" shares taken up. 3s. 9d. per share called up on 42,297 "A"; 5s. per share credited as paid on the same. 10s. per share credited as paid on 12,500 "B." Mortgages and charges: £15,000.

CITY NOTES.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

THE directors' report for the year ended December 31st, 1911, states that the operations of the past 12 months, after providing for all expenses, including repairs, maintenance, and debenture interest, resulted in a net income of £19,037. Adding the amount of £2,000 brought forward, the available balance is £21,037, which has been appropriated as follows:—Depreciation, renewals and general reserve fund accounts, £7,465; written off preliminary expenses account, £13,572. The number of passengers carried during the past year amounted to 9,640,027, and the miles run to 1,785,696, as against 9,220,853 and 1,770,028 respectively, for the previous year.

The seventh ordinary general meeting was held on Friday last at 31, Throgmorton Street, E.C., Sir H. S. Leon, Bart., presiding.

The CHAIRMAN, in moving the adoption of the above report, said that the passenger fares had amounted to £64,463, and with £1,191 from parcels, advertisements, &c., they had a total revenue of £65,655. The passengers carried numbered 9,640,027, as against 9,220,853 last year, an increase of 419,174. The miles run were 1,785,696, as against 1,770,028 in 1910, an increase of 15,668, while the increase from passengers had amounted to £2,278. The passenger receipts had averaged 8·6d. per car-mile, against 8·4d. last year, an increase of 0·2d., and the total receipts from all sources had averaged 8·824d., compared with 8·572d., an increase of 0·252d. per car-mile. The increase in traffic was only normal, and was not to be attributed to the fine weather, as the district served by the company was not a good one for pleasure traffic. The working expenses had amounted to £31,477, which left a balance of £34,177 to be carried to the net revenue. As compared with 1910, the working expenses showed a decrease of £312, despite the fact that they had run 15,668 car-miles more. Theirs was a record for economy in working, the results attained not having been equalled by any other tramway or light railway in the kingdom. It was just as well that that was the case, because their revenue per car-mile was so low, and it would have been almost impossible for them to have existed if their expenses had been as high as other systems, which amounted, on the average, to 6·55d. per car-mile, while theirs were but 4·23d., and their percentage of expenses to receipts was only 47·94 per cent. This percentage was an improvement on last year, when it was 50·28 per cent. They considered that a remarkably good figure, but it had been bettered by no less than 2·34 per cent. Considering that they only took 8·824d. per car-mile in receipts, such a result was remarkable. All they wanted was more traffic to make the undertaking successful. The service they were giving in the district was capable of accommodating more than double the number of passengers now being carried without adding one penny to the expenses. From the net revenue they had deducted £15,343 for debenture interest, income-tax, directors' fees and general expenses, leaving a balance of £19,037; and adding the amount carried forward from the previous year they had a total of £21,037. The depreciation and renewals fund account and the general reserve fund account showed the amounts that should be in cash to provide for any renewals or for any exceptional call upon the yearly revenue. As a matter of fact, they never had been so—they never had had any ready money, and he had explained to them on previous occasions the difficulty they had had in financing the business without it. They had had to pay capital expenditure out of their reserves and their revenue, and had lived from hand to mouth. Their reserves had existed only on paper, and all their money, after paying the debenture interest, had had to be used to redeem the 6 per cent. bonds, and to pay capital charges that were necessarily incurred for the proper equipment of the undertaking. He thought they ought to have a cash reserve of £50,000 ready money on which they could put their hands in the event of anything happening out of the ordinary. Fortunately, they had been exceptionally free from serious accidents, but one never knew when they might be called upon to disburse a large sum to persons who might be injured in an accident of a grave character. Again, they must be prepared for extensive renewals in a few years' time. They were keeping the property in the best possible order by constant repairing, but there must come a time when renewals would be necessary, and they must be prepared and have cash ready to meet any call of this kind. Instead of having £43,540, the total amount of the renewals fund, reserve fund and special reserve for plant insurance, in hand in cash, they had really only £6,428. The remainder had been absorbed in the business, and was not available for its proper purpose. No other course was open to them. He had often explained this; but it was now, when there was a silver streak in their financial horizon, that he thought they must appreciate the wisdom of the past actions of the directors and must be satisfied that what was done was the only practicable solution of the difficult situation in which they found themselves. During the year they had repaid the last of the 6 per cent. bonds, amounting to £12,000, so they were now entirely free of this incubus; and although they need only have paid £6,000 in the year, they paid off the whole sum of £12,000, and so saved a year's interest. He was happy to be able to say that they continued to live in peace and harmony with the numerous local authorities in their area. It was quite true that their attempt to abandon their powers to build light railways in the districts of Alverthorpe, Ardsley and Oulton, were strongly opposed before the Board of Trade last November by the various local authorities concerned, but, after all, such opposition was good-natured, and showed how the service they had rendered and were rendering to the districts, was appreciated and required. It was admitted that the tramways were a splendid success, so far as public utility and convenience were concerned, and their services were prized to such an extent that the authorities wished them to extend them, but it was forgotten and overlooked that the financial result was not equally enjoyable to those who had found the money. He could well understand the attitude of the local authorities. They did not care whether the tramways were a financial success or otherwise. They did not care whether the shareholders reaped any benefit from their enterprise or not; but they did want tramways, and they requested that they should make the lines for which they had powers quite regardless of the financial results. He would like to point out to the authorities concerned that if theoretically it was for the good of the public that town or county councils worried, and extorted money from, a company, in practice it was to the prejudice of the public. A company which had been subject to exactions which resulted in the useless expenditure of money not only could not do justice to shareholders, but could not provide the service for the people it would like to do. Everyone suffered; the public and the company, and local authorities should recognise that it was neither a wise nor a fair policy to seek to cripple the company which provided public utilities. If such a policy were carried out, it was quite certain that the service rendered by the company to the public would be inefficient and generally unsatisfactory all round. He did not think the local authorities really wished to oppress them, but they had had to spend a lot of time on this question. They had prepared estimates and considered the prospects from all standpoints, and were convinced the suggested routes could not pay if constructed, and therefore they did not intend to spend any money on them. The Board of Trade had decided to extend the time allowed for construction to November, 1912. Meanwhile they had made an offer to the local authorities, provided they would find the money for construction, to work the lines on their behalf at an agreed sum per car-mile. If this were refused, they would press their claim upon the Board of Trade for permission to abandon the unconstructed lines. Having referred to the fact that the board had last October voluntarily put in operation a new scale by which the staff would receive slightly increased wages, the chairman said that referring again to the appropriation account, as he had shown them all the money that should be in hand as a reserve had gone into the business, and they had a cash balance of £6,428 only. That money must be kept in hand. Therefore, it was quite impossible for them to pay a dividend on account of 1911, and the course they had taken, to write down the preliminary expenses, was the only possible one. He was certain no shareholder would wish them to commence paying dividends and then find that owing to quite temporary causes they were unable to continue. He did not want to be in such a position, and when they paid their first dividend on the preference shares, he wanted to feel that they were in a position to go on doing so, and that an indifferent half-year would not cause them to default. This was their policy. The prospects of the company had been brightening for some time past, and he thought he might be permitted to take some credit to himself for this; because if he had listened to some of his friends, and distributed dividends, the company would now have been in such a hopeless muddle as to preclude any chance of future ones, whereas now he thought he was in a position to say that provided everything went along smoothly, or that they did not run up against any exceptional expenditure, they would be able to declare a dividend for the six months ending June next, and he had every hope, after fully investigating the financial position, that they would be able to properly maintain such a dividend.

MR. B. NEWGASS seconded the motion.

Replying to a shareholder, the CHAIRMAN said he did not think there was any fear of motor-'bus competition. As to how it was that their expenses were so extremely low, he was not in a position to enter into all the details, but the result was the outcome of efficiency and economy in every direction.

The report was adopted.

Liverpool Overhead Railway Co.—The accounts of this company for the half-year ended December 31st last, show an available balance of £13,439, and the directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and 2 per cent. per annum on the ordinary shares, which, with the 1 per cent. paid for the half-year ended June 30th last, makes 1½ per cent. for the year, against ¾ per cent. for last year. The balance of £4,763 will be carried forward to next half-year.

Electric Construction Co., Ltd.—The directors announce the interim dividend of 7 per cent. per annum on the preference shares for the half-year ended November 30th, payable on January 31st.

City and South London Railway Co.

THE report of the directors for the half-year ending December 31st, 1911, states that the receipts from all sources amounted to £91,040, and the cost of working was £43,291, leaving a profit of £47,748. Inclusive of the balance brought forward from June 30th last, the net revenue account shows an aggregate total of £50,589. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £35,165. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of 1½ per cent. per annum be paid upon the consolidated ordinary stock for the half year, leaving a balance of £2,815 to be carried forward.

Half-year (inclusive of estimated number of season ticket journeys.	No of passengers.	Receipts (including season tickets).	Div. per cent. per ann. on ord. stock.
June 30th, 1910 ...	12,357,324	£83,412 11 2	1¼
December 31st, 1910	12,800,719	86,102 15 8	1¾
June 30th, 1911 ...	13,318,622	87,590 11 8	1¾
December 31st, 1911	12,840,839	85,316 14 5	1½

The amount carried forward, £2,815, compares with £1,788 in the corresponding period in 1910. The largely-increased amount proposed to be carried forward is not more than such as the directors think should be kept in hand, in view of further increases in wages to which they are committed under the agreement mentioned below, and in view also of increases in the cost of materials necessary to the working of the system. The peculiar form of competition to which the enterprise is exposed precludes the recouping of these increased costs by any corresponding increase in fares, such as is open to many other railway companies to adopt. The strike in August last caused a loss of receipts and occasioned outgoings amounting together to about £700. Omnibus and tramway competition has further developed; increased sums for local rates have become payable since 1910, and the exceptionally fine summer of 1911 was not favourable to underground travelling. Apart from the increase in expenses due to the greater mileage run, there is an increase of about £400 in wages, consequent on the concessions made under the terms of the agreement for rates of pay and hours of duty, announced in July, 1910, as having been made with certain classes of the staff. The construction of the subway referred to in the report for the half-year ended December 31st, 1910, providing easier access between the stations of the Metropolitan, Great Northern and City and this railway at Moorgate Street is well in hand.

Prospectus.—*Tramways (M.E.T.) Omnibus Co., Ltd.*—The list is to close to-day in an issue of £100,000 4½ per cent. guaranteed debenture stock of this company which is offered by the Electric and General Investment Co. at 96¼. The stock is guaranteed unconditionally both as to principal and service fund by the Metropolitan Electric Tramways, Ltd. The company has an authorised share capital of £200,000, divided into shares of £1 each, of which 100,000 have been subscribed by the Metropolitan Electric Tramways, and a similar number by the B.E.T. Co.; 1s. per share has been paid up. The company intends to operate services of motor-omnibuses primarily as feeders in connection with the system of electric tramways and light railways worked by the Metropolitan Electric Tramways, Ltd. The proceeds of the issue will enable the omnibus company to purchase 100 new motor-omnibuses and to provide the necessary garages and equipment, and leave a margin for contingent requirements.

Metropolitan Railway Co.—For the past half-year the directors recommend a dividend at the rate of 1¾ per cent. per annum on the consolidated stock, carrying forward £9,200. A year ago 1½ per cent. per annum was paid, and £9,498 was then carried over. The dividend on the surplus lands stock is also announced for the past half-year at the rate of 2¾ per cent. per annum, the same as a year ago.

Allis-Chalmers Co.—We read in the *Electrical World* that an announcement was issued on December 30th to the effect that interest on the first mortgage 5 per cent. bonds due January 1st would not be paid. Our contemporary, however, says that a receivership is not a necessary consequence of this announcement. The bondholders' and stockholders' committees are working in harmony with the company on measures that will accomplish the conservation of the property, and plans are under consideration which may place the company in a better condition than ever.

Metropolitan District Railway Co.—Subject to final audit of the accounts, the directors have decided to recommend the payment of a dividend on the 4 per cent. guaranteed stock for the six months ended December 31st, 1911, at the rate of £4 per cent. per annum, the same as in the corresponding period of last year. The directors have also decided to recommend the payment of a dividend on the first preference stock of the company for the six months ended December 31st, 1911, at the rate of £4 10s. per cent. per annum, as against £3 10s. per cent. per annum in the corresponding period of last year, and the payment of a first dividend on the 5 per cent. second preference stock of the company for the half-year ended December 31st, 1911. at the rate of £2 per cent. per annum, £10,000 has been reserved for renewals, and the carry forward is £2,000.

Dundee and Broughty Ferry and District Tramway Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. on the preference stock

London United Tramways, Ltd.

THE report of the directors to be submitted at the meeting to be held at Winchester House, E.C., on Tuesday, January 30th, states that the operation of the company's undertaking during the year ending December 31st, 1911, resulted in the gross receipts amounting to £343,987, and the working and general expenses, maintenance and repairs to £219,033, leaving, with the balance brought forward from last account, a net revenue of £125,768. After payment of interest on debenture stock and loans for the year, and providing for income-tax, there remains a balance of £56,432, an increase of £25,618 as compared with the preceding year. The available revenue would have sufficed for a dividend distribution on the preference shares, but the directors consider that in the company's best interests it is advisable for this year to continue to strengthen the reserves by appropriating the sum of £30,000 to a general reserve. Of the remaining balance the directors propose to place £25,000 to reserve for renewals and contingencies, and to carry £1,432 forward to next year's accounts. With the amount now added, the reserve for renewals and contingencies will total £76,033. The gross receipts show an increase of £10,328, and the working expenses a decrease of £15,178, resulting in an increase in net revenue of £25,506 as compared with the previous year. The number of passengers carried during the year was 62,547,128, an increase of 2,414,677 over the number carried during the preceding year. The undertaking has been well maintained and extensive improvements made to the permanent way during the year; 7,500 rail joints have been repaired by the cast welding process, making a total of 11,250 joints similarly dealt with to date. This method of levelling up the rail joints and thus improving the surface of the rails has proved very efficient, and has resulted in smoother running of the cars. The total cost of improvements made during the year, including the balance of expenditure on improvements to the power house, commenced in the previous year, amounted to £18,365, of which £16,265 has been charged to the reserve for renewals and contingencies. Forty cars have been equipped with covered tops, completing the number of 100 cars which it was intended to so equip. The Bill promoted by the company in the last session of Parliament extending the time for one year for the electrification of the tramway along Kew Road, Richmond, received the approval of Parliament. The company is promoting a Bill in the ensuing session of Parliament seeking powers for a further extension of time for the construction of the Kew Road line. Provision is also made in the Bill for the abandonment of the line unless the Richmond Corporation shall have exercised their powers to purchase the tramway, or, in the alternative, given their consent to the use of the overhead trolley system. The directors are still unable to place before the shareholders any definite information with regard to the sale to the London County Council of the company's tramways within the Borough of Hammersmith.

London Electric Railway Co.—The directors recommend a dividend at the rate of 1 per cent. per annum on the ordinary stock for the past half-year, with the transfer of £7,500 to renewal account, carrying forward £2,400. This time last year ¾ per cent. per annum was paid, a similar amount was placed to renewal account, and £3,474 was carried forward.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Central London Railway Co.—£885,000 4½ per cent. preference stock, in lieu of the scrip, together with £96,000 additional 4½ per cent. preference stock.

Para Electric Railways and Lighting Co., Ltd.—45,000 additional 6 per cent. cumulative preference shares of £5 each fully paid, Nos. 70,001 to 115,000.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors recommend a balance dividend on the 7 per cent. preference shares for the half-year ending December 31st, 1911, of 3s. 6d. per share, and 5s. per share on the ordinary shares, making with the interim dividend paid thereon a total distribution of 10 per cent. The dividend for 1910 was at the same rate.

Direct United States Cable Co., Ltd.—The board have resolved upon the payment of an interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum for the quarter ending December 31st, 1911, payable on and after the 31st inst.

Blackpool and Fleetwood Tramroad Co.—The directors have declared a dividend for the half-year at the rate of 9 per cent. per annum and a bonus at the rate of 1 per cent. on the ordinary shares, both free of tax.

STOCKS AND SHARES

Tuesday Evening.

ACTIVITY in the Stock Exchange remains centred round the comparatively few spots of interest. Amongst these, the various issues connected with London traffic absorb the greater amount. Since we were last writing, there has been a recurrence of the gambling in Districts, Underground Electric income bonds, and London United Tramways, as well as in the Ordinary stock of the London General

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Jan. 17	2,765	+ 251	33	50,276	+ 2,891	..	..
Ayr	„ 20	362	+ 10	36	11,625	+ 139	8	..
Bath	„ 20	1,872	+ 65	3	2,127	+ 150	..	..
Birkenhead	„ 21	2,088	+ 119	42	48,560	+ 1,775	13·68	..
Birmingham Corp.	„ 18	21,243	+7,067	41	360,541	+75,449	56·8	..
Blackburn	„ 17	2,026	+ 222	42½	49,576	+ 4,185	14·6	..
Blackpool Corp.	„ 18	841	+ 140	..	59,900	+ 7,829	..	..
Blackpool-Fleetw'd	„ 20	439	+ 61	2	730	+ 19	..	..
†Bolton	Dec. 2	2,412	+ 172	36	90,575	+ 6,040	26	..
Bournemouth	Jan. 17	3,040	+ 345	42	76,178	+ 265	21·9	..
Bradford	„ 14	9,953	+ 225	41	226,405	+14,204	56	1·2
Brighton	„ 21	1,579	+ 138	42½	44,472	+ 2,515	9·5	..
Bristol	„ 19	12,232	+3,566	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Jan. 12	614	+ 149	2	535	+ 129	3·65	..
Barnsley	„ 12	865	+ 23	„	298	+ 23	..	..
Barrow	„ 12	794	+ 159	„	495	+ 131	5·37	..
Devonport	„ 12	1,068	+ 166	„	912	+ 151	8·85	..
Gateshead	„ 12	2,175	+ 99	„	1,775	+ 68	11·25	..
Gravesend	„ 12	428	+ 53	„	347	+ 40	6·5	..
Greenock	„ 12	1,359	+ 185	„	1,137	+ 141	7·25	..
Hartlepool	„ 12	501	+ 72	„	416	+ 62	6·72	..
Kidderminster	„ 12	188	+ 17	„	148	+ 8	..	..
‡Leamington	„ 12	284	+ 34	„	242	— 2	..	..
Merthyr	„ 12	399	+ 43	„	329	+ 33	2·9	..
Metropolitan	„ 12	17,046	+1,978	„	14,218	+ 1,511	22	..
Middleton	„ 12	485	— 8	„	473	+ 1	8·5	..
Mid. Joint Com'tee	„ 12	5,983	+ 164	„	4,978	+ 263	..	..
Oldham—Ashton	„ 12	1,180	+ 73	„	933	+ 64	9·13	..
Peterborough	„ 12	236	+ 20	„	189	+ 25	5·81	..
Potteries	„ 12	4,020	+ 250	„	3,394	+ 226	29	..
Rothesay	„ 12	153	+ 30	„	134	+ 29	2·75	..
Southport	„ 12	487	+ 25	„	429	+ 23	8·17	..
S. Metropolitan	„ 12	1,515	+ 114	„	1,235	+ 78	..	..
Swansea	„ 12	2,251	+ 198	„	1,909	+ 160	19·5	..
Tynemouth	„ 12	301	— 19	„	252	— 13	3·75	..
Weston-s-Mare	„ 12	66	+ 19	„	51	+ 20	3	..
‡Worcester	„ 12	515	+ 10	„	434	— 5	5·75	..
Wrexham	„ 12	201	+ 22	„	162	+ 18	..	..
Yorks. Wool. Dist.	„ 12	2,226	+ 217	„	1,849	+ 98	17	..
Miscellaneous	„ 12	415	+ 16	„	342	+ 10	..	..
Burnley	Jan. 20	2,616	+ 231	..	..	..	11·7	..
Burton-on-Trent	„ 21	588	+ 54	42	12,257	+ 640	6·6	..
†Bury	„ 14	1,163	+ 114	40½	53,294	+ 4,969	22·5	..
Cardiff	„ 20	4,647	+ 532	44	103,937	+ 7,743	..	..
Chatham and Dist.	„ 19	1,572	+ 17	3	2,049	— 40	15	..
Cork	„ 18	913	+ 68	3	1,176	+ 30	9·89	..
Croydon	„ 12	3,358	+ 283	41	74,446	+ 5,104	11·4	..
Darlington	„ 20	488	+ 53	43	9,543	+ 897	..	..
Darwen	„ 19	471	+ 27	42	11,361	+ 806	4·36	..
Dover	„ 18	419	+ 46	41	10,696	+ 1,439	4·75	..
Dublin	„ 19	10,914	+ 819	..	15,019	+ 1,129	54·2	..
Dundee	Dec. 22	2,212	+ 57	27	52,513	— 760	15	..
East Ham	Jan. 20	2,114	+ 327	42	46,616	+ 2,666	15	7·13
Exeter	„ 19	516	+ 46	42	14,564	+ 964	5·5	..
Glasgow	„ 20	24,564	— 143	..	637,573	+38,023	98	·25
Hastings	„ 18	1,441	+ 57	..	..	+ 203	..	..
Huddersfield	„ 20	3,121	+ 104	42	81,188	+ 7,559	29·5	1
Hull	„ 23	6 025	+ 5 2	42	124,206	+ 6,886	14·5	..
Ilkeston	„ 18	250	+ 26	42	5,761	+ 123	..	..
Ipswich	„ 20	628	+ 41	42	18,906	+ 1,011	10·5	..
Kilmarnock	„ 13	372	+ 37	35	5,887	+ 442	4·25	..
Lancashire United	„ 17	2,385	+ 45	3	3,078	+ 31	89	..
Leeds	„ 18	14 475	+ 936	41	317,065	+21,175	50·75	2
†Leicester	„ 20	5,062	+ 595	..	..	..	..	..
Leith	„ 20	1,166	+ 95	35	23,524	+ 1,859	8·7	..
Liverpool	„ 13	24 377	+ 2,095	..	23,361	+ 2,042	116	..
‡L.C.C.	„ 10	87,612	+4,320	..	1,802,460	+91,111	138·4	6
London United	„ 20	10,862	+ 479	..	15,719	+ 642	..	..
Lowestoft	„ 20	291	+ 7	16	2,769	+ 48	8·5	..
Manchester	„ 20	31,148	+1,440	42	687,345	+36,589	113	..
Newcastle	„ 20	8,185	+ 434	..	181.883	+14,254	14·5	..
Newport	„ 18	1,382	+ 93	41	29,3 4	+ 1,035	14·5	..
Oldham	„ 21	3 596	+ 175	43	88,686	+ 3,870	28·75	·5
Pontypridd	„ 20	774	+ 39	42	17,610	+ 56	5·5	..
Portsmouth	„ 13	3,735	+ 262	41	92,450	+ 6,770	15·25	..
Preston	„ 17	1,409	+ 65	42	33,236	+ 2,165	..	..
Rotherham	„ 18	1,309	+ 98	41¾	29,170	+ 2,374	12	..
Salford	„ 16	9 445	+ 513	41½	208,444	+ 9,019	..	..
Sheffield	„ 23	12 811	+ 682	..	580,049	+17,989	40	..
Southampton	„ 17	2 350	+ 334	42	52.427	+ 6,014	22	..
Southend-on-Sea	„ 17	923	+ 100	42	29,351	+ 4,491	..	..
South Shields	„ 20	1,114	+ 68	42	26,615	+ 2,885	..	..
†Swindon	„ 10	152	+ 26	..	6,678	+ 732	..	..
Tyneside	„ 17	810	+ 90	8	1,021	+ 81	..	..
Wallasey	„ 13	2 129	+ 271	40½	45,960	+ 6,084	..	..
Walthamstow	„ 20	1,318	+ 158	42	31,812	+ 1,965	9	..
West Ham	„ 11	5,380	+ 475	41	112 368	+ 9,758	15·25	..
Wolverhampton	„ 17	1,886	— 17	42	41,812	+ 2,067	25	..
Cen. London Rly.	„ 20	‖10,431	— 671	3	15,475	— 1,382	6·22	..
†City & S. Lon. Rly.	„ 21	3,515	— 10	3	10,349	— 518	7·25	..
Dublin-Lucan Rly.	„ 19	216	+ 14	3	293	+ 3	7	..
G.N. and City Rly.	„ 20	3 448	+ 224	3	5,161	+ 312	3·5	..
L'pool Overh'd Rly.	„ 21	2 890	+ 143	..	4,418	+ 220	3·8	4·8
Llandudno-Col. Bay	„ 19	254	+ 36	7·5	1,003	+ 125	..	..
Lond. Elec. Ry. Co.	„ 20	30,670	+ 1,555	3	45,585	+ 1,650	21·25	..
Mersey Railway	„ 20	4 221	+ 80	3	6,392	+ 121	4·5	..
Metropolitan Rly.	„ 21	85,092	+ 355	3	52,795	+ 538	25·75	..
Met. District Rly.	„ 20	25,518	+ 1,898	3	38,058	+ 1,758	25	..
Anglo-Argentine	„ 21	99,119	+2,467	..	150,544	+ 2,579	..	..
§Auckland	Dec. 15	18.098	+1,857	6	99.479	+ 8,068	28·31	..
Bombay (B.E.T.)	„ 8	8,789	+ 3,242	49	146,254	+11.913	..	..
§Brisbane	Dec.	24,280	+3,105	52	252,100	+30,555	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Jan. 22	8 605	+1,921	..	..	+ 3,414	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Dec.	3 389	..	..	41,333	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Jan. 15	1,570	— 102	..	..	..	..	..
§Montevideo	Dec.	29 068	+2 419	2	55,707	+ 4,947	..	..
Perth (W.A.)	Jan. 19	3 915	+ 521	..	5,528	+ 871	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

Omnibus Company, the huge increase in the price of the latter being accountable in no small degree for the rise in hopes and prices in respect of other stocks and shares. Marconis, too, are a very lively market, and West India and Panama shares fluctuated wildly.

The struggle for control of the London General Omnibus Company has brought about a check to the long ascent in the price. It was on Monday that the decline started, and with it came a sharp setback in the price of Underground Electric income bonds, which had been up to 85 a few days previously, but which slipped back again to 80. The shares are lower at 2¾, but the market as a whole shows a good deal of strength, and the satisfactory dividend announcement by the London Electric Railways Company has helped to keep prices up. The District dividend, too, makes a good showing, and Districts, after rising to nearly 36, still show a gain on the week at 33¾. Metropolitan Consolidated sagged off slightly, despite a fairly good dividend announcement. It was only in the last issue of this journal that we were drawing attention to Great Northern and City Preferred Ordinary shares as the only ones amongst Tube Railways that had not moved during the recent excitement over Underground Railways. Someone apparently has taken the hint or noticed the same thing, the price at 35s. now showing a rise of 12s. 6d. per share. There are comparatively few about, the market is a limited one, and to the gambler £10 shares at such a price present attractive possibilities when there is anything doing in similar securities.

City and South London again suffered by reason of what is considered a disappointing dividend, and this reacted upon Central London Ordinary, which fell 1, while the Preferred and Deferred remain weak. London United Tramways Preference went back to 3⅜, the advent of another motor-omnibus company rather chilling the recent bullishness.

Marconis, which have been in the front rank of active shares, jumped from 3 5/16 to 3⅞, reacting a little from the top, and the Preference shares have come up from 2¾ to a full 7s. 6d. higher. Apparently the weak account which the last Stock Exchange settlement revealed has been thinned out; at all events, support is being given to the shares. West India and Panama Telegraphs, which have been running Marconi's very close in the amount of speculative interest, soared to 5¼, at which price heavy selling took place on the part of those who had good profits to secure, and back came the quotation to 4⅜ with a run. The rise on balance this week is 9/16. The buying of these shares is based on what may be expected by the company when the Panama Canal is opened for traffic; and although this latter event is still some way ahead, the excellent progress which the Telegraph Company has been making of late years is considered sufficient to justify a stride in the quotation for the shares. Both Preference issues are higher.

Apart from Marconi's and Panama Telegraphs, there is not much doing in this section. Little practical attention has been given to the idea of the United States taking over for the State, the telegraph and telephone business of the country. Anglo-American Deferred is ¼ down, on anticipations of a reduction in the dividend, and a similar fraction came off the price of Direct United States Cable shares. West Coast of America are 1/16 harder. National Telephone stocks continue to dwindle, falls being marked in the Preferred and Deferred. Globe Telegraph Preference gained ¼ upon a slight investment demand. New York Telephone Bonds have again improved, but Mackay Common slipped back $2 in sympathy with the uncertainty in the American Railway market.

English Electricity Supply shares are remarkably quiet, the only quotable change being ¼ rise in City of London Ordinary. There is some demand for Debenture stocks, in which County First Debenture, Midland Electric Debenture, Edmundson's and Urban Debenture, have participated to the extent of ½ to 2 per cent.

There has been a big recovery in Sao Paulo Light and Power, lifting the price once more to almost 200. Montreal Light, Heat and Power is very nearly the same price. This department, as a whole, is good, with the exception of British Columbia issues, which have given way generally. The fall in the latter has extended to the Debentures, the offer of new Vancouver Debentures causing sales of the other securities. Bonds in this section are distinctly firm. Rio Trams have gone ahead after their fall, and at one time got up to 118½, reacting later to 117. Mexico Trams are better as regards the Common shares and the 5 per cent. Bonds. Shawinigan issues have hardened, the Capital stock gaining 3. Canadian General Common went up 3½ points, although the Preferred fell 1. The business being done in these descriptions is on a large scale, and the dealers in this department have as much as they can do to cope with the work brought to them.

The recent big rise in River Plate Ordinary stock, taking it to 255, has drawn attention to some of the other Argentine issues, amongst which are La Plata Trams Ordinary shares—the price of these is about 14s. middle. The company is making good progress. Manaos Trams, which were introduced into the market not long since, are about a shilling higher in price. This, of course, is not the place for giving tips, but, as a speculative investment, the La Plata Trams, at all events, seem well worth locking up. The recent little spurt in Kalgoorlie Electric Power Ordinary shares, which took the price up to 7s. 6d. middle, has subsided somewhat, and the quotation is a shade easier at 7s. middle, the 6 per cent. Preference being 15s. United Electric Trams of Monte Video are slightly lower, but Para Electric Ordinary have risen ¼, Calcutta Preference gaining an equal amount.

Amongst manufacturing shares, Babcock & Wilcox are 1/8 down this week, after their steady rises for so long. Henleys eased off to 12⅛ and other manufacturing issues are firm. The rubber market has quieted down, business falling away, to some extent, and causing a mild reaction in the prices of the leading shares, but a rally in the raw stuff occurred on Tuesday afternoon, and the share market again improved.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Jan. 23rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7⅞ — 8⅜	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	9†	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7⅛ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5†	3¾ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	93 — 96	..	4 8 4
Chelsea, Ord.	5	5	4†	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	6†	13⅜ — 13⅝	+ ⅛	5 2 9
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord.	10	5	4†	9 — 9⅛	..	5 5 3
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	107 —109	+1	4 2 7
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	+1	5 4 8
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82 xd	..	5 9 9
London Electric, Ord.	3	2	.	1¾ — 2	..	3 0 2
Do. 6 % Pref.	5	6	6	4¾ — 4⅞	..	6 3
Do. 4 % First Mort. Deb.	Stock	4	4	86 — 91	..	4 8 0
Metropolitan	5	5	4†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	95 — 97	+ ½	4 12 9
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	9⅞ — 10⅛	..	..
Oxford	5	7½	6†	6½ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 8½	..	5 17 8
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 19 1
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2⅞ — 3⅛	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 — ⅛	..	6 4 5
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 10 11
Urban, Ord.	5	5	..	⅞ — 1	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	88 — 90	+2	5 0 0
Westminster, Ord,	5	10	10†	7⅞ — 8⅛	..	6 1 2
Do. 4½ % Cum. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Calcutta, Ord.	5	8½	7†	6¼ — 6⅜	..	6 6 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	93½ — 95½	..	5 4 9
Canadian Gen. El. Com.	$100	7	7†	116 —120	+3½	5 16 8
Do. 7 % Pref.	$100	7	7	117 —121	—1	5 15 8
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	88 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5/16 — 3/8	..	Nil
Do. 6 % Pref.	1	6	6	15/16 — 1 1/16	..	7 7 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅜ — 3½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —103	+1	4 17 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87 — 89	..	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	87½ — 89½ xd	+1½	4 9 5
Do. 7 % Cum. Pref.	$100	7	7	107½ —109½	..	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	98 —100	+ ½	5 0 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91 xd	..	5 10 0
Montreal, Lt., H. and Power	$100	7	8	195 —200	+1½	3 10 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 3 10
River Plate, Ord.	Stock	10	.	250 —260	..	3 16 11
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —118	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	100⅜ —102½	..	4 17 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	128 —130	+3	3 1 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	+ ½	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	+ ½	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91— 93	..	5 7 6
Victoria Falls Power, Pref.	1	Nil	11/16d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ —108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7 — 7⅛	..	..
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	—1	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	144 —146	..	5 9 7
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3¾	3†	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111 —112	..	5 7 2
Do. Def.	Do.	30/-	..	26½ — 27	— ⅛	5 11 1
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101½ —103½	+ ½	4 16 7
Chili Telephone	5	7	..	7 3/16 — 7 5/16 xd	+ ⅛	4 14 1
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	10¾ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8½ — 8⅝	..	5 14 8
Do. 4½ % Debs.	50	4½	4½	98½ —100¼	..	4 9 7
Direct United States Cable	10	4½	..	7⅜ — 9½	— ⅛	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98½ —100½	..	4 9 7
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —138	—1	5 0 9
Do. 8½ % Pref. Stock	Do.	8½	8½	83 — 85 xd	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	100 —102	—1	3 18 5
Eastern Extension	10	7	5†	13½ — 13⅝ xd	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	10⅜ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	13 — 13½	+ ¼	4 9 0
Great Northern Telegraph	10	18	5†	32 — 33	..	5 9 1
Indo-European Telegraph	25	13	5†	55½ — 58½	..	5 10 2
Mackay Companies Common	$100	5	5†	78 — 81	—2	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	69 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	5	..	3 3/16 — 3 5/16	+ 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	3 — 3⅛	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	1⅜ — 1½	..	5 13 11
Do. 5 % Pref.	1	5	5	1 3/16 — 1 1/8	..	5 6 8
National Telephone, Pref.	Stock	6	6†	100 —103 xd	—1½†	5 16 6
Do. Def.	Do.	6	6†	121½ —123½ xd	—1	4 17 2
Do. 6 % Cum. 1st Pref.	10	6	6	9½ — 10 xd	..	6 0 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10 xd	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 7/16	..	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	+ ½	4 7 0
Oriental Telep. and Elec.	1	8	..	1⅜ — 1⅝	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 18 8
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	..	4 9 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98½ —100½	..	3 19 7
Reuter's	8	5	5†	8⅞ — 9⅛	..	4 6 6
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 8
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100	..	4 10 0
United River Plate Telephone	5	8	8	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1½ — 1⅝	+ 1/16	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98½ —100½	..	3 19 7
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4⅜	+ 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 11	+ ⅛	5 9 1
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10½	+ ¼	5 14 4
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	6†	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4 % Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	+1	4 6 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 23rd.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅜	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — ¾	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	..	..	..
Do. 6 % Pref.	10	1½	1½	..	..	..
Do. 5 % Deb.	100	5	5	95 — 98	+1	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3†	67 — 69	−1	4 6 11
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	56 — 58	..	3 9 0
Do. 4 % Deb.	100	4	4	100 —102xd	..	3 18 5
City & South London, Ord.	100	1½	1¾†	28½ — 29½	— ½	5 1 8
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr't. Ord	10	Nil	..	1⅜ — 1⅝	+ ⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	7/16 — ½	..	..
Do. 4½ % Deb.	100	4½	4½	75 — 80	+2	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	2⅞	2⅞	2⅜ — 2⅞	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	76½ — 79½	..	6 5 9
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3½ — 3⅝	— ⅛	..
Do. 4 % Deb.	100	4	4	75 — 78	..	5 2 7
Metropolitan Railway Consol.	100	1⅜	2†	46 — 46½	— ¼	2 19 2
Do. Surplus Lands	100	2½	3†	67 — 69	+1	3 19 9
Do. 3½ % Deb.	100	3½	3½	90 — 92 xd	..	3 16 1
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 — 87	..	4 0 6
Metropolitan District Ord.	100	Nil	..	33½ — 34	+ ⅜	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	8½	4½†	91 — 93	..	3 10 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	5†	33/32 — 1 1/32	..	5 6 6
Do. Def.	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % Pref.	1	5	5	31/32 — 1	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	99 —101	—1	4 9 1
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	90 — 93	..	4 16 9
South Metro. Trams, 6 % Pref.	1	6	..	5/16 — 7/16	..	6 17 2
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	2⅜ — 2⅞	— ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	79 — 81	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	Nil	..	2¾ — 3¼	+ ¼	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5¼†	5 1/16 — 5 1/16	+ 1/16	5 3 6
Do. 2nd Pref.	5	5	5¼†	4 15/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	94 — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101½ —103½	+ ½	4 16 7
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 11 10
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅜	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	+ ½	5 1 0
Brisbane Trams Invt., Ord.	5	8	8†	8⅜ — 9½	+ ⅛	4 6 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	101 —104	..	4 1 7
B. Columbia Elec. Rly., Def.	100	8	8†	137 —140	−1	5 14 4
Do. Pref. Ord.	100	6	6	118 —122	−2	4 18 4
Do. 5 % Pref.	100	5	5	107½ —110½	−1	4 10 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104 xd	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101 —103	−1	4 7 5
Calcutta Trams, Ord.	5	6	..	5½ — 6	..	5 0 0
Do. 5 % Pref.	5	5	5	5 — 5½	+ ⅛	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	3/16 — 3/16	+ 1/16	..
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	..	4 5 1
Do. 4 % Deb.	100	5	5	95 — 98	..	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —105 xd	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	58 — 62	..	8 1 4
La Plata Elec. Trms, Ord.	1	6	6	33/32 — 1	..	6 0 0
Do. Pref.	1	..	..	11/16 — 13/16	..	..
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93½ — 97½	..	5 2 7
Madras Elec. Tr. (1904), Deb.	$1000	5	5	93½ — 96½	..	5 3 8
Manaos Trams & Lt., 1st Deb.	100	5	5	90½ — 92½	..	5 8 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	101 —103	+ ½	4 17 1
Mexico Trams Com.	$100	7	7†	123½ —125½ xd	+ ½	5 11 7
Do. Gen. Con. 5 % Bonds	..	5	5	99½ —101½	+ ½	4 18 6
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅜ — 7½	+ ⅛	6 13 4
Do. 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 5 6
Do. 5 % 1st Deb.	100	5	5	97½ — 99½	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	15/16 — 1	..	2 10 0
Do. 5 % 1st. Deb.	100	5	5	99 —101	..	4 19 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 2 2
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	116½ —117½	+1½	3 16 7
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	97 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	197 —199	+6	5 0 6
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	6½ — 5⅞	— ⅛	5 4 4
Do. 6 % Pref.	5	6	6	5⅞ — 6⅛	— 1/16	5 11 7
Do. 5 % 1st Deb.	100	5	5	98½ —101½	..	4 18 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/32 — 3/16	..	..
Do. 6 % Pref.	1	9	6	2⅞ — 3	..	7 2 2
Babcock & Wilcox	1	26	24†	6 3/16 — 6 7/16	— 1/16	4 0 9
Do. Pref.	1	6	6	1 3/16 — 1 5/16	+ 1/16	3 16 10
B.I. & Helsby Cables	5	10	8†	6⅝ — 7⅛	..	7 0 4
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	..	1/32 — 1/16	..	Nil
Do. Deb.	100	4	4	54 — 57	..	7 0 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — ¼	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	9 — 9⅜	..	7 13 10
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	98 —100	−1	4 10 0
Castner-Kellner	1	17½	20	8 1/16 — 8 3/16	— 1/16	4 11 10
Do. Deb.	100	4½	4½	106 —110	+1	4 1 10
Crompton & Co.	3	Nil	Nil	⅛ — ¼	..	Nil
Do. Deb.	100	5	5	58 — 68	..	7 7 1
Dick, Kerr	1	5	..	27/32 — 29/32	+ 3/32	5 3 1
Do. Pref.	1	6	6	1 3/16 — 1 5/16	..	5 12 11
Do. Deb.	100	4½	4½	92½ — 95½	..	4 14 3
Edison & Swan, A, £3 paid	5	Nil	..	1/32 — 1/16	..	Nil
Do. fully paid	5	Nil	..	1/32 — 2/32	..	Nil
Do. 4 % Deb.	100	4	4	70 — 74	..	5 8 1
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	3/32 — 7/32	..	..
Do. Pref.	2	7	7	1 3/16 — 1 5/16	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8⅞ — 9⅛	..	5 8 1
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅞ — 12⅛	— ⅛	6 2 5
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 5 11
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	10 — 12	..	..
Do. Pref.	10	5	5	9¾ — 10¼	..	4 17 7
Telegraph Construction	12	20	10†	34½ — 36½	+ ½	6 17 0
Do. Deb.	100	4	4	99½ —101½	..	3 18 10
Willans & Robinson	1	Nil	..	1/32 — 1/16	..	Nil
Do. Pref.	5	Nil	..	1/16 — 1/8	..	Nil
Do. Deb.	100	4	4	53 — 58	..	7 9 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1911.

BY contrast with the excellent returns for electrical business in all sections during November last, the figures for the closing month of the year are a little disappointing.

The export total of £375,000 included only some £25,000 worth of telegraphic material, as against over £100,000 worth in November, and, of course, compares unfavourably with the £527,000 worth of export business during that month. It may be of interest to note that the December total compares with a monthly average during 1911 of £385,000, and during 1910 of £473,000—the last-mentioned year containing some unusually large telegraphic exports.

Neglecting the telegraphic business, the December export figures are, however, considerably above the averages obtaining in 1911 and 1910, due, no doubt, to the respectable total of electrical machinery exported during the month—roughly, £160,000.

As regards the imports, the total of £207,000 compares with £230,000 in the previous month, and is probably quite up to the average of the year; the re-export total £24,391 compares with £25,049 in November, remaining at a fairly high level.

The month's returns include some £17,000 worth of glow lamps and £3,000 worth of arc lamps and parts exported, and it is of interest to contrast these figures with the £48,000 worth of similar goods which entered this country from abroad—the latter figure, of course, showing a great reduction as compared with the £78,000 worth of such imports recorded for December, 1910. The various purchasing countries remain much as usual, but attention may be drawn to the improving Australian figures.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning] imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	743	528	167	25	166	960	6,904	804	176	...	81	28	10,582
Germany	800	1,878	172	5	555	9	1,305	4	...	16	316	347	5,407
Netherlands, Java and Dutch Indies ...	625	1,380	35	59	35	79	758	24	8	...	90	331	3,424
Belgium	355	200	255	6	271	5	1,742	113	...	12	988	13	3,960
France	2,496	16	1,029	67	59	25	4,372	875	3	...	687	310	9,939
Portugal	34	47	...	127	11	...	178	515	25	9	...	192	1,138
Spain and Canary Isles	240	36	166	42	10	50	1,038	734	4	...	...	124	2,444
Switzerland, Italy and Austria-Hungary ...	714	126	803	6	79	11	2,772	100	58	3	14	2,006	6,692
Greece, Roumania, Bulgaria, Servia & Turkey	44	48	39	54	14	...	497	...	25	6	...	74	801
Channel Isles, Gibraltar, Malta and Cyprus...	164	59	62	52	38	51	108	...	...	5	7	571	1,117
U.S.A., Philippines and Cuba	502	53	36	356	37	54	584	...	...	...	4	7,182	8,808
Canada and Newfoundland	755	1,836	371	2,697	27	2,243	6,411	4,601	94	151	189	679	20,054
British West Indies and British Guiana ...	155	53	397	229	37	...	95	31	7	12	93	16	1,125
Mexico and Central America	44	7	49	55	9	...	1,224	1,187	...	6	60	12	2,653
Peru, Uruguay and Paraguay	325	922	152	88	16	125	668	...	56	3	9	7	2,371
Chile	245	381	299	92	8	...	5,002	489	43	8	105	183	6,855
Brazil	135	864	669	883	46	444	5,812	1,598	911	50	1,325	1,380	14,117
Argentina	2,384	10,532	831	1,135	443	418	11,113	2,019	6,700	277	2,648	3,431	41,931
Colombia, Venezuela, Ecuador and Bolivia	40	134	...	118	5	4	254	...	...	4	8	...	567
Tripoli, Tunis, Morocco and Liberia ...	...	4	13	7	...	...	28	...	...	...	...	97	149
Egypt and Persia	766	489	347	88	326	49	2,493	9	1,585	3	288	276	6,719
British West Africa and St. Helena ...	86	45	15	41	...	26	93	...	108	...	13	67	494
Rhodesia, O.R.C. and Transvaal	2,567	1,170	350	1,899	79	208	7,384	...	287	118	183	5	14,250
Cape of Good Hope	2,047	3,655	795	984	53	426	3,478	663	485	38	170	287	13,081
Natal	1,343	7,124	166	768	208	111	1,577	2,772	175	6	157	1,617	16,024
Zanzibar, Brit. E. Africa, Mauritius & Aden	86	97	74	104	12	8	200	2	2	...	37	87	709
Azores, Madeira and Portuguese Africa ...	199	857	126	50	13	...	254	7	4	22	10	123	1,665
French African Colonies and Madagascar ...	15	5	16	...	...	...	7	...	...	...	...	...	43
China and Siam	499	515	311	124	34	139	1,630	...	512	...	1,618	5	5,387
Japan and Korea	339	2,358	65	22	...	1,055	17,602	2,615	21	...	5,020	975	30,072
India	3,799	9,055	2,305	2,428	172	1,189	12,159	4,104	1,752	50	1,154	624	38,791
Ceylon	250	801	156	97	5	25	5	...	8	5	63	65	1,480
Straits Settlements, Fed. Malay States and Sarawak	591	789	241	91	7	75	594	1,276	68	121	158	307	4,318
Hong Kong	196	2,894	208	28	...	262	261	...	...	3	190	109	4,151
West Australia	364	126	118	940	24	220	412	97	78	10	1,247	70	3,706
South Australia	1,053	896	375	206	5	52	1,870	283	5	10	87	30	4,872
Victoria	3,183	10,042	553	646	...	641	2,721	15	436	...	1,340	1,131	20,708
New South Wales	3,028	7,436	863	952	75	1,639	13,946	1,353	1,771	23	1,021	36	35,143
Queensland	271	1,274	71	189	...	131	3,546	2,519	185	9	1,782	1,896	11,873
Tasmania	18	488	...	112	...	...	12	480	...	...	...	34	1,144
New Zealand and Fiji Islands	2,425	1,309	736	835	43	391	8,954	32	312	5	946	456	16,444
Total, £	33,925	70,529	13,436	16,707	2,922	11,125	130,063	29,521	15,704	985	25,108	25,183	375,208

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	174	...	...	103	...	...	6,420	...	356	29	9,663	16,745
Germany	2,460	4,936	1,251	31,448	7,229	2,703	41,806	...	2,026	7,073	36,293	137,225
Holland	...	...	...	1,346	382	...	17	...	...	15	...	1,760
Belgium	964	457	205	5	60	238	1,675	15	662	802	6,330	11,413
France	296	440	1,169	333	977	771	856	130	831	4,553	868	11,224
Switzerland	24	496	129	36	...	16	3,185	...	...	...	30	3,916
Italy	14	102	...	...	18	...	24	...	...	...	2,270	2,428
Austria-Hungary	21	990	...	1,090	144	...	20	...	64	399	45	2,773
United States	1,673	97	521	3,021	1,726	15	6,931	4,781	721	91	135	19,712
Total, £	5,626	7,518	3,275	37,382	10,536	3,743	60,934	4,926	4,660	12,962	55,634	207,196

Additional imports: Spain, carbons, £85; Canada, goods, £117; Japan, machinery, £3.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,728	435	...	2,892	623	...	7,988	...	89	383	253

TOTAL EXPORTS: £375,208. TOTAL RE-EXPORTS: £24,391. TOTAL IMPORTS: £207,401.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRICAL EXPORTS AND IMPORTS DURING 1911 AND PREVIOUS YEARS.

THE figures for electrical export and import business during the closing month of 1911, which we publish on the previous page, complete the returns for last year. As in previous years, we have, for the convenience of our readers, graphically reproduced the more important figures for the last few years for the purpose of comparison.

Turning to the first set of curves, fig. 1, it will be seen that the exports have continued their general upward tendency of the past few years, although the gross value of the exports during 1911 (dot and dash curve) was over a million pounds less than during the preceding year (£4,600,000, as compared with £5,700,000), due to several exceptional telegraphic exports which occurred during that period, as shown in the adjoining curves. It is interesting to note that the electrical exports from this country, *exclusive* of telegraphic material, averaged during 1911 roughly £338,000 per month, as compared with £285,000 and £234,000 respectively in the two preceding years.

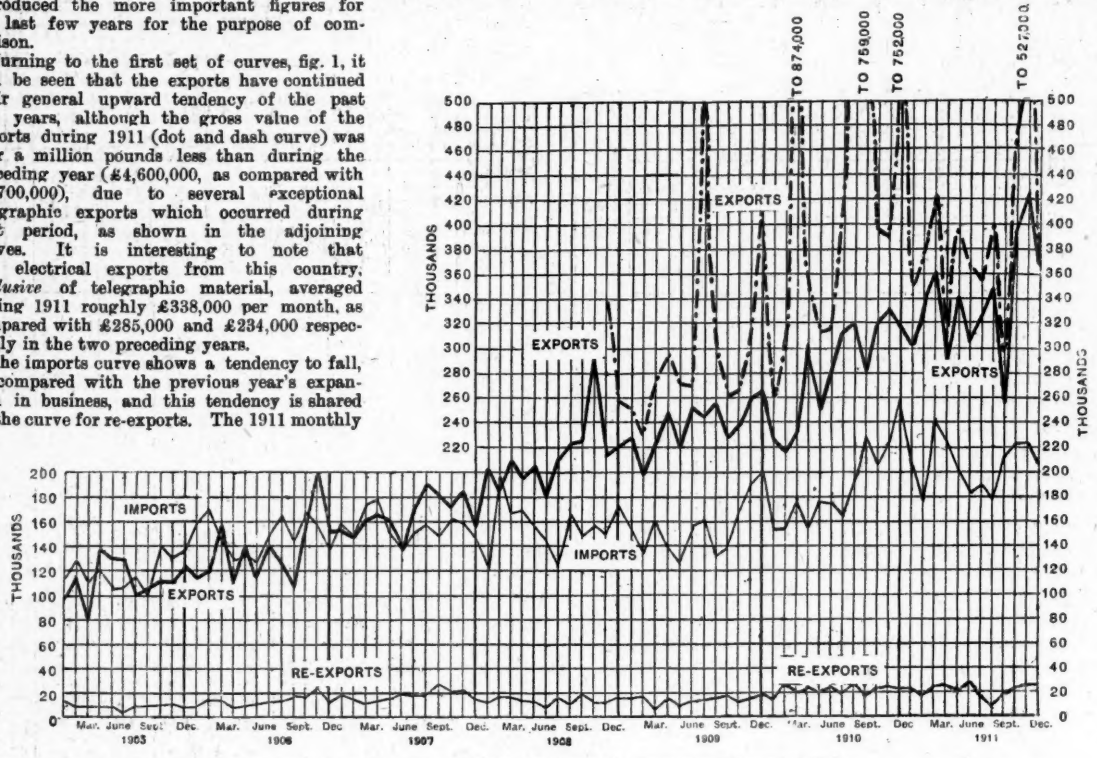
The imports curve shows a tendency to fall, as compared with the previous year's expansion in business, and this tendency is shared by the curve for re-exports. The 1911 monthly average of the imports, however, was over £200,000, as against £189,000 during 1910.

Incidentally, it will be seen that the telegraphic export business during 1911 was rather featureless.

Steady progress was, however, made by our export business in electrical machinery and cables, as shown in fig. 2; these two items constitute the major portion of our electrical export trade, and the improvement is reflected in the average export figures given above.

The chart showing the three principal imports, fig. 3, is particularly interesting, indicating, as it does, a great decline in value in the importation of foreign lamps, due presumably to the numerous lamp factories which have been opened in this country during the past 12 months or so. In passing we may note that the exportation of lamps from this country has not appreciated to any extent during the year.

The importation of telegraphic and telephonic material remained steadily at a higher level than during 1910, while machinery imports probably doubled in value as compared with that year.



The upper export curve is inclusive of telegraphic exports from November, 1908.

FIG. 1.—CHART SHOWING MONTHLY ELECTRICAL EXPORTS AND IMPORTS DURING THE PAST SEVEN YEARS.

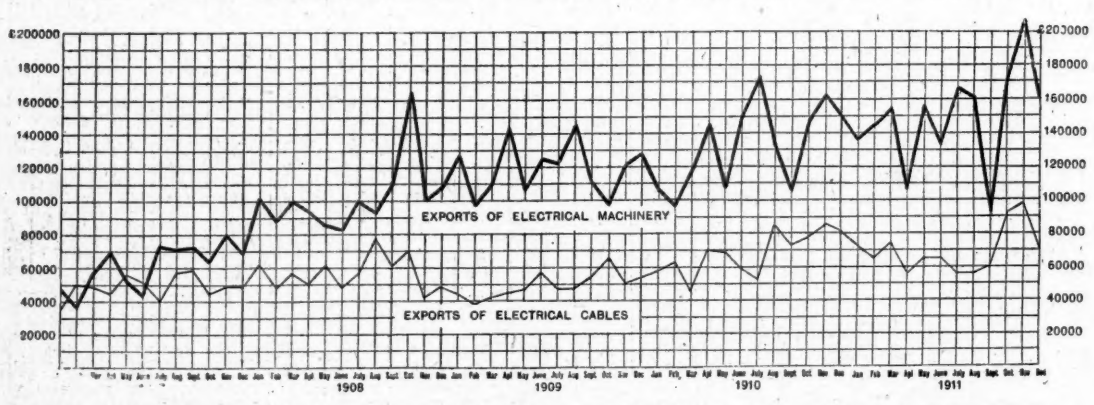


FIG. 2.—MONTHLY EXPORTS OF ELECTRICAL MACHINERY AND ELECTRICAL CABLE, OTHER THAN TELEGRAPHIC OR TELEPHONIC CABLE, DURING 1907-11 INCLUSIVE.

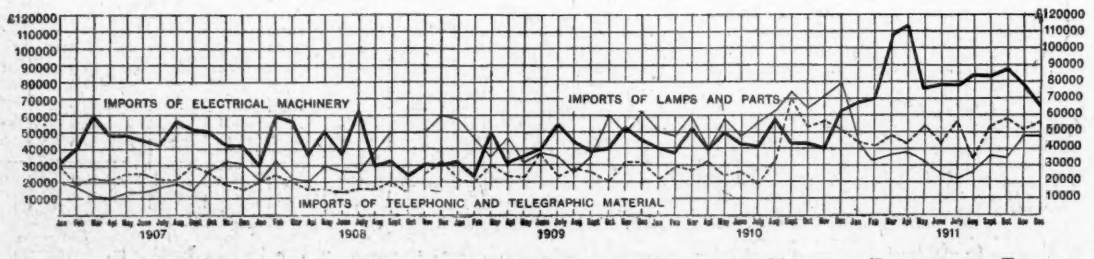


FIG. 3.—MONTHLY IMPORTS OF ELECTRICAL MACHINERY, TELEGRAPHIC AND TELEPHONIC MATERIAL (INCLUSIVE OF TELEGRAPHIC AND TELEPHONIC CABLE AFTER NOVEMBER, 1908) AND ELECTRIC LAMPS AND PARTS, DURING 1907-11 INCLUSIVE.

PURCHASING COUNTRIES AND IMPORTERS INTO THE UNITED KINGDOM.—Under this heading we publish in up-to-date form the series of curves which appeared last January, grouping some of the leading purchasers of British electrical goods, also the most prominent importers of similar goods into this country.

Thus the curves shown in fig. 4, cover three years' business with our leading American customers, and on the whole indicate a steady rather than an expanding business with the three countries represented, viz., Canada, Argentina and Brazil. During the years

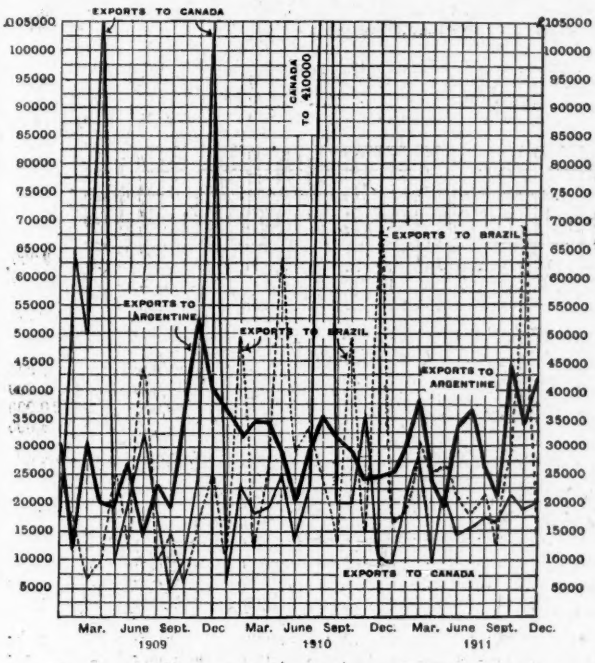


FIG. 4.—EXPORTS TO CANADA, ARGENTINA, AND BRAZIL, 1909-11.

1909 and 1910, several abnormal telegraphic purchases—indicated by the peaks in the curve—were responsible for very high totals in the case of Canada; this year's curve shows a normal general trade.

The fifth set of curves deals with our South African and Australasian markets, comprising in the former case, Cape Colony, Natal, Transvaal, Orange River Colony and Rhodesia, and in the latter case, Australia and New Zealand.

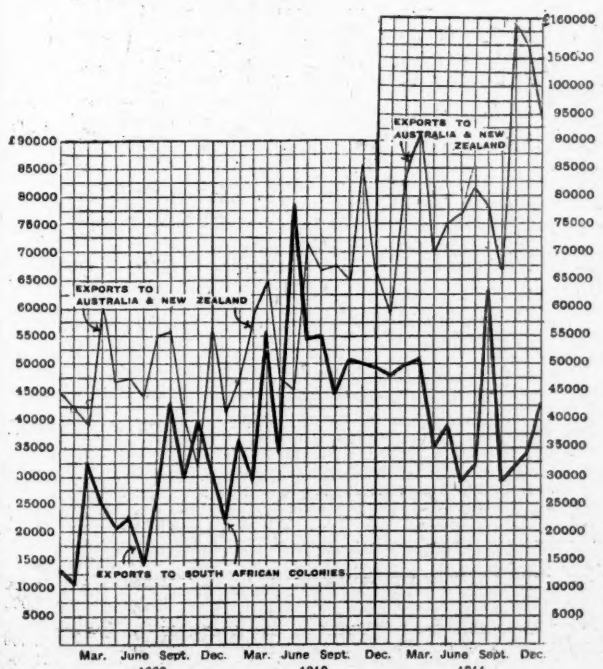


FIG. 5.—EXPORTS TO AUSTRALASIA AND SOUTH AFRICA, 1909-11.

The trend of the curve showing South African business is somewhat disappointing after the steady upward tendency of the years 1909 and 1910. On the other hand, Australasian business appears to be rapidly expanding, the improvement shown being quite equal to that during 1910.

The sixth set of curves deals with our Indian and Far Eastern business, and it would appear that on the whole, Indian, Japanese and Chinese business did not vary greatly during the three years

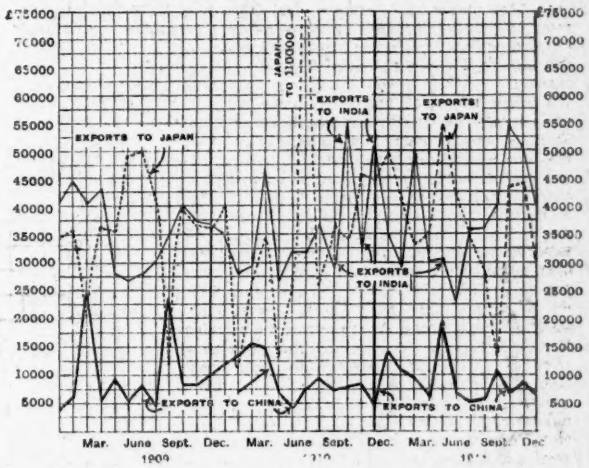


FIG. 6.—EXPORTS TO JAPAN, INDIA AND CHINA, 1909-11.

shown—although Chinese business shows a tendency to fall off, a fact which we noted last year.

The last set of curves, fig. 7, deals with the most important countries importing into the United Kingdom, and it is of interest

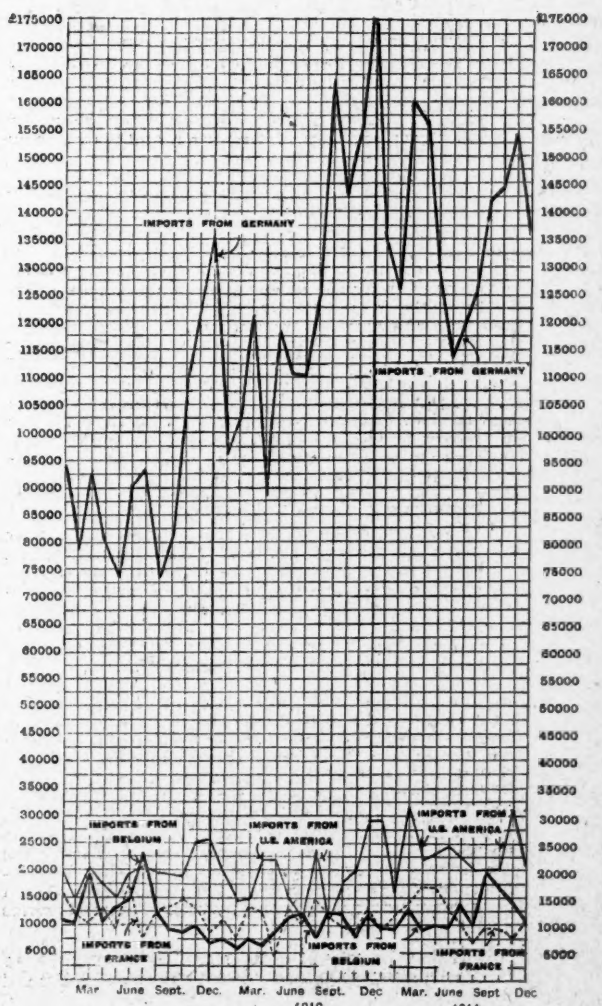


FIG. 7.—IMPORTS FROM GERMANY, U.S.A., BELGIUM AND FRANCE, 1909-11.

to note that the giant strides made by Germany during 1909 and 1910, have, to some extent, been arrested, although Germany's total electrical business with us was probably greater in 1911 than in

1910. From the other curves shown, it will be seen that American imports reached an appreciably higher level last year, as compared with 1910, and that Belgian imports have also moved upwards, while French importations show no particular movement.

GENERAL.—The conclusions which one may draw from the export curves, as a whole, are satisfactory as regards the most important branches of our business—viz., machinery and cables; the telegraphic export business, the fluctuating character of which has been remarked upon from time to time, was the dullest feature of the year's returns.

The only really satisfactory instance of expanding business in 1911, shown in the curves, is in the case of our Australasian Colonies—of the other examples chosen, the best that can be said is that business, generally, compared favourably with the previous year.

Turning to the import curves, the marked increase in value of foreign machinery entering this country in 1911 seems to require some explanation, this being really the only section of the import business which is making any great headway in the home market.

New Zealand New Patents Act.—MR. J. OWDEN O'BRIEN, chartered patent agent, of 6, Bank Street, Manchester, writes as follows:—

"We have received information that an Act relating to patents, designs and trade marks, has recently passed the Legislature in New Zealand, and is to come into force on July 1st next.

"The Act has been based principally upon the British Patents Act, 1907, and contains most of the provisions of such Act with the exception of that relating to the liability to revocation of a patent, should the invention of which it is the subject be manufactured mainly abroad. Instead of this provision, the provision of the Australian Act, 1909, has been embodied in the new law. The position of patents, therefore, will be that at any time not less than four years from the date of the patent, and not less than two years after the commencement of the Act, any person may petition for an order declaring that the patented article or process is not manufactured or carried on in New Zealand to an adequate extent. An order may then be issued, to take effect at once, or at a future date, and during the currency of the order the patent will not be infringed by the manufacture or carrying out of the process in New Zealand by others. Provision is made for the revocation of the order should its benefits not be availed of.

"Thus, in any event, the patentee will retain full patent rights, so far as the right to import the patented article into New Zealand is concerned. Consequently, therefore, the patentees of inventions that cannot be manufactured in New Zealand, or manufactured at a price to compete with the imported article, need not take any steps to manufacture within the Dominion in the period referred to.

"The Act provides for the investigation of the novelty of an invention before the grant of the patent, and for the refusal of the application, or for its grant, on condition that a reference to the anticipations be inserted in the specification. An appeal from the Registrar's decision may be made to the Supreme Court.

"Hitherto it has been possible to oppose the grant of a patent on any grounds, but the new Act limits the grounds of opposition to certain specified objections corresponding with those allowed under the present British Act of 1907.

"The Act also follows the British provisions, so far as it relates to patents, in respect to a single patent for cognate inventions covered by separate provisional specifications; patent of addition; restoration of lapsed patents; compulsory licences; revocation of patents on grounds of invalidity; exemption of innocent infringer from damages; the individual rights of co-patentees: restriction on conditions of sale of patented articles; the granting of costs and giving of security for costs in opposition and other proceedings; the exemption of a patent from the effect of unauthorised or unknown prior publication of the invention; and the exemption of a patent from invalidity because of disconformity between the complete and provisional specifications.

"For design registrations the only important departures made by the new Act are those by which the term of registration (five years) may be extended for two further periods of five years each, and for the same working provisions that apply to patents being applied to designs, with the exception that manufacture must commence within one year of the date of registration.

"The Trade Mark provisions of the new Act follow closely those of the British Act of 1905 with respect to registrable Trade Marks, and we consider that the practice under this Act will follow that built up under the British Act. They provide as well for the lodging of security of costs by an opponent in opposition proceedings, or an appellant from a decision of the Registrar, where such opponent or appellant is outside New Zealand. They also provide for the registration of associated marks."

Solid Metal Solution.—A remarkable example of diffusion of solid metals has been observed by Messrs. G. Bruni and D. Meneghini, and is quoted in the *Electrical World*. A nickel wire was coated with copper by electrolysis, to a thickness such that the two metals were in the same proportions as in the alloy Constantan (40 per cent. nickel, 60 per cent. copper). The compound wire thus formed was then maintained at a temperature of about 1,000° C. for 157 hours. Its resistance was 0·0260 ohm at the start, and was measured at intervals; it gradually rose to 0·2105 ohm, at which it became practically constant. This indicated that the wire had become converted to Constantan, and the fact was proved by chemical analysis.

TRADE STATISTICS OF AUSTRALIA.

THE following statement, showing the imports of electrical and similar goods into Australia during the year 1910, is taken from the recently issued official trade statistics. The figures for 1909 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1909.	1910.	Increase or decrease.
Plumbago or graphite.—	£	£	£
From Great Britain ...	6,000	6,000	—
„ Ceylon	1,000	1,000	—
„ United States ...	1,000	1,000	—
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	9,000	10,000	+ 1,000
Gas and oil engines.—			
From Great Britain ...	104,000	125,000	+ 21,000
„ France	1,000	1,000	—
„ United States ...	31,000	40,000	+ 9,000
„ Other countries ...	3,000	—	— 3,000
Total ...	139,000	166,000	+ 27,000
High-speed reciprocating steam engines.—			
From Great Britain ...	564,000	124,000	— 440,000
„ Germany	13,000	11,000	— 2,000
„ United States ...	30,000	40,000	+ 10,000
„ Other countries ...	1,000	4,000	+ 3,000
Total ...	608,000	179,000	— 429,000
Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof.—			
From Great Britain ...	119,000	129,000	+ 10,000
„ Germany	32,000	23,000	— 9,000
„ United States ...	71,000	73,000	+ 2,000
„ Sweden	3,000	5,000	+ 2,000
„ France	4,000	3,000	— 1,000
„ Italy	3,000	4,000	+ 1,000
„ Switzerland ...	3,000	2,000	— 1,000
„ Other countries ...	1,000	4,000	+ 3,000
Total ...	236,000	243,000	+ 7,000
Dynamo-electric machines over 200 H.P. and parts.—			
From Great Britain ...	13,000	22,000	+ 9,000
„ Germany	9,000	1,000	— 8,000
„ United States ...	10,000	3,000	— 7,000
„ Other countries ...	1,000	—	— 1,000
Total ...	33,000	26,000	— 7,000
Generators for direct coupling to steam engines.—			
From Great Britain ...	25,000	5,000	— 20,000
„ Germany	3,000	7,000	+ 4,000
Total ...	28,000	12,000	— 16,000
Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards.—			
From Great Britain ...	11,000	19,000	+ 8,000
„ Germany	3,000	3,000	—
„ United States ...	11,000	17,000	+ 6,000
„ Other countries ...	2,000	2,000	—
Total ...	27,000	41,000	+ 14,000
Flue-heated economisers, mechanical stokers, steam traps, steam turbines, superheaters, water purifiers.—			
From Great Britain ...	35,000	56,000	+ 21,000
High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps.—			
From Great Britain ...	21,000	30,000	+ 9,000
Motive-power machinery not elsewhere specified.—			
From Great Britain ...	134,000	192,000	+ 58,000
„ France	4,000	5,000	+ 1,000
„ Germany	6,000	6,000	—
„ Switzerland ...	3,000	1,000	— 2,000
„ United States ...	50,000	72,000	+ 22,000
„ Other countries ...	4,000	3,000	— 1,000
Total ...	201,000	279,000	+ 78,000
Electroliers, gasoliers, pendants, brackets, &c.—			
From Great Britain ...	28,000	26,000	— 2,000
„ Germany	4,000	2,000	— 2,000
„ Other countries ...	1,000	1,000	—
Total ...	33,000	29,000	— 4,000

	1909.	1910.	Increase or decrease.
	£	£	£
Electric fittings and appliances; switches, fuses and lightning arresters.—			
From Great Britain ...	17,000	20,000	+ 3,000
„ Germany	7,000	6,000	— 1,000
„ United States ...	4,000	6,000	+ 2,000
„ Other countries ...	1,000	3,000	+ 2,000
Total ...	29,000	35,000	+ 6,000
Electric heating and cooking appliances.—			
From Great Britain ...	1,000	2,000	+ 1,000
„ Other countries ...	1,000	—	— 1,000
Total ...	2,000	2,000	—
Other electric light and gas appliances (except gas meters).—			
From Great Britain ...	62,000	79,000	+ 17,000
„ Germany	39,000	43,000	+ 4,000
„ United States ...	12,000	19,000	+ 7,000
„ Other countries ...	13,000	13,000	—
Total ...	126,000	154,000	+ 28,000
Rails, fishplates, &c., for railways and tramways.—			
From Great Britain ...	437,000	400,000	— 37,000
„ Canada	133,000	—	— 133,000
„ Belgium	22,000	15,000	— 7,000
„ Germany	70,000	34,000	— 36,000
„ United States ...	140,000	372,000	+ 232,000
„ Other countries ...	1,000	—	— 1,000
Total ...	803,000	821,000	+ 18,000
Telephones, telephone switchboards and appliances.—			
From Great Britain ...	74,000	46,000	— 28,000
„ Germany	8,000	5,000	— 3,000
„ Sweden	20,000	40,000	+ 20,000
„ United States ...	5,000	3,000	— 2,000
„ Other countries ...	9,000	11,000	+ 2,000
Total ...	116,000	105,000	— 11,000
Electrical articles: Accumulators, arc lamps, arc lamp carbons, cable and wire covered, carbon in blocks of 12 sq. in. and over, electrical vacuum tubes, measuring and recording instruments, prepared insulating tape.—			
From Great Britain ...	164,000	277,000	+ 113,000
„ France	2,000	3,000	+ 1,000
„ Germany	42,000	61,000	+ 19,000
„ United States ...	11,000	10,000	— 1,000
„ Other countries ...	3,000	7,000	+ 4,000
Total ...	222,000	358,000	+ 136,000
Iron and steel wire.—			
From Great Britain ...	75,000	116,000	+ 41,000
„ Belgium	11,000	14,000	+ 3,000
„ Germany	306,000	381,000	+ 75,000
„ United States ...	158,000	180,000	+ 22,000
„ Other countries ...	3,000	9,000	+ 6,000
Total ...	553,000	700,000	+ 147,000

MACHINERY FOR INDIA.

THE following notes recently appeared in the *Indian Trade Journal* from the pen of Mr. Frederick Noël-Paton, who is the Director-General of Commercial Intelligence, India :—

The movement towards manufactures and the use of machinery in India has become unmistakable; and India is now the largest single purchaser of machinery from England. But in India it is often, if not usually, found that the circumstances of a particular industry differ from those present in countries where the manufacturing processes have been evolved and long practised. For this reason an element of uncertainty and risk attaches to the first ventures in India; and if to these deterrents to investment others be added, it becomes inevitable that capitalists with any business sense should hold back. One such additional and unavoidable deterrent is due to the remoteness of India from the Western centres where experts and specialised appliances abound. As a consequence of India's isolation, difficulties are encountered even by wealthy and intelligent native gentlemen who want information about the approximate capacity and cost of the complete installation requisite for a given industry for which raw material and demand are present.

The central Government and certain of the provincial Governments in India have in recent years appointed officers one of whose functions it is to procure and supply information of this kind. On one side their duties are analogous to those of a Consul or Commercial Attaché. These officers travel from time to time about the territories assigned to them: and they report that they receive many *bonâ fide* inquiries from persons qualified financially and by intelligence to establish useful works. But they have to reckon with the absence of co-operation between British makers of machinery.

Many engineers in England make only part of the appliances required in a given industry. In Europe this matters little; for it is possible for any respectable man of business in the West to find makers of the complementary plant, and to consult them with a view to completing the requisite estimate. The several firms who produce appliances for carrying out the distinct but connected processes in a given industry know each other, and are prepared to work together when a definite order is in sight.

But they are indifferent to or definitely suspicious of inquiries not related to a specific project and a known individual or group. They have found by experience that inquiries of this kind are often made by people who have no serious intention of placing an order, or who, if they have such intention, are quite likely to place the order elsewhere after having used the estimate obtained from one source to "spring" the rates quoted in another quarter. Indeed, this is not the limit of the misuse sometimes made of estimates indiscriminately given; and it must be recognised that the attitude of manufacturers in this matter is not only deliberately assumed, but is justified.

But it is believed by many experienced commercial intelligence officers that it would pay manufacturers to carry discrimination a little further, and that while ignoring specious and merely plausible inquiries from persons who profess to contemplate business, it would be worth their while to assist officials who seek to create in backward countries an active public interest in those industries which the said manufacturers want to equip.

A manufacturer will often spends large sums in advertisement and in sending travellers in quest of really improbable orders. Agents are appointed in India by such firms; or travelling representatives visit the country for the purpose of selling one part only of the plant required for a particular industry; and they are often disappointed by results. One of the causes of such failure is that their quotations for one part of the plant have no practical interest for capitalists in the absence of quotations for the rest of the plant, and the agent has not been put in a position to give information about the whole. Another is that the ground has not been prepared, the capitalist's interest in the matter has not been awakened or instructed, and he has not gone into the questions of material and demand. Consequently, the traveller often finds no one to whom he may address himself.

Now, one of the duties of a commercial intelligence officer in a backward country is to direct the attention of the community to such openings as seem to exist for the exploitation or development of the country's resources. Until interest has been so awakened there can be no effective demand for the machinery required. But before a mere interest can be converted into effective demand for machinery, the capitalist must be given some sort of idea of what it would cost him to start work on a given scale. The commercial intelligence officer is anxious to give him the information in order that development may take place; and it is obviously to the interest of manufacturers as a class that it should so take place, since an incident in the progress must be the placing of orders for appliances. But manufacturers commonly do not realise the wide difference that exists between the specious call for estimates made by an unknown or too well known individual and the request for a *pro forma* but comprehensive quotation to be used by an official in preparing the ground for business.

It is not necessary or even desirable that the estimates furnished should go forth as that of a particular maker. On the one hand, the firm would object to their names being connected with it; because it might be used against them by a customer or by a rival when the elaboration of a specific scheme called for modifications in detail. On the other hand, the commercial intelligence official would object to the firm's name being associated with a figure which he quoted; because he might be thought to be favouring a particular maker. So here again the wishes of the maker and the official are identical.

All that is necessary is that manufacturers or their agents should exercise the forethought they expect of the official when they have recourse to his services, and should interest themselves in seeing that through one channel or another he will receive a full complement of information about all the appliances necessary for a given industry. In most cases the manufacturer knows what other appliances are required, and what their power or capacity should be. He knows where a suitable engine could be obtained, and where—say suitable crushers or centrifugals could be bought to complete the equipment. In such cases it would be sufficient if he dropped a line to the makers of the complementary plant saying that a certain official wanted information about a plant for such-and-such an industry, stating that the writer was sending drawings and approximate quotation for such-and-such appliances of stated capacity, and asking that his correspondent should forward similar information about such-and-such complementary appliances of corresponding capacity. In certain foreign countries organisation and co-operation among manufacturers has been carried further than in England; and co-ordination between officials and manufacturers is more highly developed. Even in England most of the great firms go out of their way to help the official, knowing very well that he really does create a set of conditions favourable to the prospects of their business. But there are many others whose operations have never brought them in contact with a commercial intelligence office. They have not the least idea as to what it sets out to do, and they consequently regard it as merely troublesome

and inquisitive. There can be little doubt that so long as this view exists a good deal of business will fail to take shape, or will continue to go to those countries whose manufacturers and officials play thoroughly into each others' hands. For neither the capitalist nor the official can wait indefinitely.

A VECTOR CALCULATOR.

BY F. ADDEY, B.Sc.

IN the calculations involved in dealing with questions of telephone transmission and similar problems, we are concerned largely with vector quantities. We can, of course, plot our vectors to scale, and perform the necessary mathematical operations by graphical methods. It is much more convenient, however, to express the vector quantities in an algebraical form, and to perform the calculations by algebraical processes.

A vector may be expressed algebraically in two ways. Let O P (fig. 1) be a vector $\hat{R}$ of magnitude R, making an angle θ with the axis O x. Let a and b be the rectangular

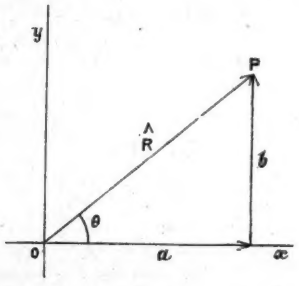


FIG. 1.

components of the extremity P of the vector. We may then either express the vector O P in terms of its magnitude R, and its angle θ, or else in terms of its rectangular components a and b.

By the first method the vector is written—

$$\hat{R} = R \angle \theta,$$

while by the second method, considering a and b as vectors, we may write—

$$\hat{R} = \hat{a} + \hat{b}.$$

Now a is along the O x axis, which is the axis from which the angle θ is reckoned, while b is at right angles to this axis. Therefore we may write b as $\sqrt{-1}\, b$ or $i\, b$, and our vector becomes—

$$\hat{R} = a + ib.$$

It can easily be shown that to add or subtract vectors we must add or subtract the real parts to obtain the real part of the resultant, and add or subtract the imaginary parts to obtain the imaginary part of the resultant. Thus, if

$$\hat{R} = a + i\,b \text{ and } \hat{S} = c + i\,d,$$

$$\text{we have } \hat{R} + \hat{S} = (a + c) + i\,(b + d).$$

On the other hand, to multiply or divide vectors, we multiply or divide the magnitudes to obtain the magnitude of the product or quotient, while we add or subtract the angles to obtain the angle of the product or quotient. Thus, if

$$\hat{R} = R \angle \theta \text{ and } \hat{S} = S \angle \phi,$$

$$\text{we have } \hat{R} \times \hat{S} = RS \angle \theta + \phi.$$

Thus, for addition and subtraction, we must have our vectors expressed in the form $\hat{R} = a + i\,b$, while for multiplication and division they are best expressed in the form

$$\hat{R} = R \angle \theta.$$

In telephone calculations it is continually necessary to transform a vector from one of these forms to the other. From fig. 1 we see that if the vector be expressed in the $a + i\,b$ form, we have—

$$R = \sqrt{a^2 + b^2} \text{ and } \theta = \tan^{-1} b/a,$$

while, if the vector be expressed in the form $R \angle \theta$, we have $a = R \cdot \cos \theta$ and $b = R \cdot \sin \theta$. In a problem involving much calculation, these transformations occupy a considerable length of time, and in order to avoid this inconvenience the writer has devised a simple calculator based on a method given by Dr. Franke (*Elektrotechnische Zeitschrift*, 1891, page 451) which enables the transformation from one form to the other to be immediately performed.

The arrangement of this calculator is shown in fig. 2.

A 10-in. square is drawn on a sheet of xylonite. The sides of this square are divided into inches and tenths, and the whole is ruled up as squared paper. A strip of transparent

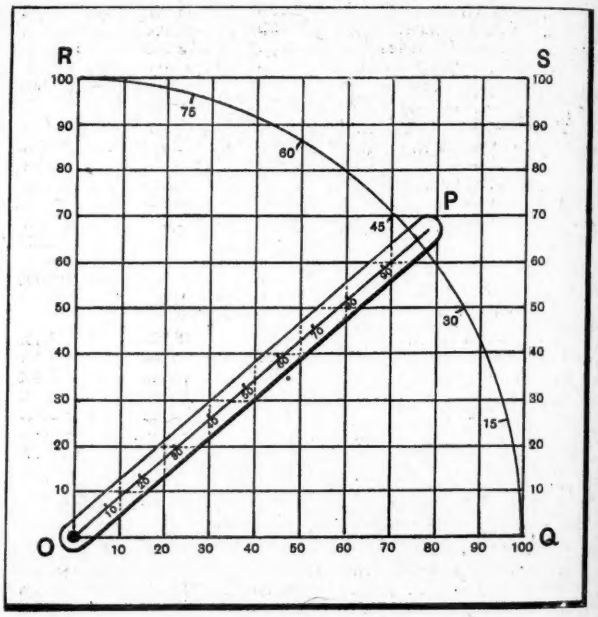


FIG. 2.

celluloid O P is pivoted at the point O. A line is ruled along the under surface of this strip passing through the point O. This line is also divided into inches and tenths.

A quadrant Q P R is described about the centre O with a radius of 10 in., and this quadrant is divided into degrees.

If a vector be given in the $R \angle \theta$ form, and it be required to transform it into the $a + i\,b$ form, the arm O P is set to the value of θ on the quadrant, the extremity of the radius R noted by means of the graduations on the arm O P, and then the value of a is read off at once from the side O Q, and the value of b from the side Q S.

If, on the other hand, the vector be given in the form of $a + i\,b$, the line on the arm O P is set on the point of which the co-ordinates are a and b, and then the value of R can at once be read from the graduations on O P, and the value of θ from the arc Q R.

For rough work, good tenth-squared paper could be employed, but xylonite is a far better material, especially when the instrument has to be frequently used.

Exhibition in Spain.—The Union de Productores de Espana para el Fomento de la Exportacion has decided to hold an international exhibition in December next, in the Universidad Industrial at Barcelona. Besides a display of the products of Spain, there will be a section set apart for machinery in operation, chiefly agricultural, where English electrical engineering firms may exhibit the advantages of their particular specialities. Cargo-handling appliances, in connection with a cinematograph review of the principal ports of the world, will also be among the features. —*Industria e Invenciones.*

ELECTRICITY AND PLANT GROWTH.

THE value of experimental research has been over and over again demonstrated in the way that laboratory and small scale experiments have led the way to practical applications on a commercial basis of electricity to many spheres of utility

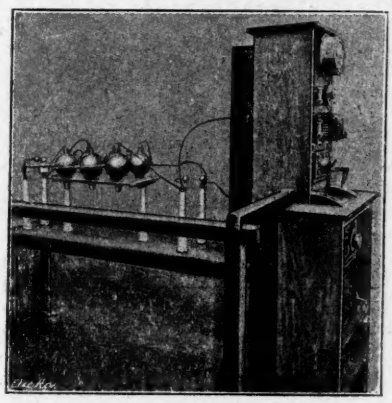


FIG. 1.

which, at first sight, appeared to be beyond the range of this form of energy. It is, perhaps, not beside the mark to refer to the fixation of atmospheric nitrogen as an example of the unexpected developments which may occur from the practical application of facts which were well known in the laboratory, to a process which may do very much to revolutionise the economics of agriculture, and the success with which this is now, especially in Norway, demonstrated to be workable on a commercial and paying scale, makes one bold enough to hope that in the future we shall see the successful commercial application of researches which are at the present time proceeding with regard to the application of electricity to another department of agriculture. This work, which is at present only in its initial stages, is the use of electrical static discharges from overhead conductors, in order to stimulate the growth of cereals and root crops planted beneath the electrical conductors. Even at the present time it is demonstrated, without fear of contradiction, that at any rate with some forms of plant growth, the stimulating action of high-tension and high-frequency discharges is most marked; and although up to now the experiments have not proceeded long enough and on a large enough scale to enable accurate and uniform results as to the increase of the value of crops compared with the cost of the electric discharge to be obtained, the results have been sufficiently encouraging to warrant us in making somewhat extensive reference to the means and methods adopted. By the courtesy of Prof. J. H. Priestley, of the Department of Economic Biology of the University of Bristol, we are able to reproduce interesting photographs of some portions of the apparatus used, and some of the results achieved thereby, but before referring particularly to this, it may be interesting to abstract briefly from Mr. Priestley's paper on "Overhead Electrical Discharges and Plant Growth," in the *Journal* of the Board of Agriculture, and from his recent paper on "Electricity in Relation to Horticulture," before the Royal Agricultural Society, some account of the present position of this new development.

For the purpose of obtaining the high-tension and high-frequency discharges in the experiments carried out by Lemström, the electric influence machine was used in order to charge the conductors above the crop, but it was found to be difficult to keep machines of this type running continuously for long periods with a satisfactory discharge, and also, owing to the small quantity of electricity obtained by this means, the wires had to be kept comparatively close to the ground in order to secure an adequate discharge upon the crops. This meant that the men employed on the field were hampered in their movements by the network of wires. It was only when Sir Oliver Lodge developed his high-tension valve for use in connection with an induction coil similar to those used in X-ray work, that high voltages and high-frequency currents of a continuous and ample nature could be obtained. By the courtesy of Mr. Lionel Lodge, of the Research Laboratory of the University of Birmingham, we are able to show an illustration in fig. 1 of a high-tension discharge set suitable for use in this connection. The Lodge valve is simply a vacuum tube which allows the current to pass in one direction and prevents its return, thus acting in a similar manner to the valves in an ordinary water pump. Its action depends entirely upon its shape, which was arrived at chiefly by experiment. The discharge set shown in the illustration gives the valve in position and other details of the apparatus as used by the Agricultural Electric Discharge Co., of Gloucester, which has done a great amount of experimental work at Evesham in connection with electric discharges for stimulation of plant growth. Owing to the high voltages which can be obtained in connection with the use of this valve, and its steady running properties, it is possible to raise the network of overhead conductors to a considerable distance above the ground, enabling men to work below them, and a minimum amount of attention is required to secure continuous running. Mr. J. E. Newman, of the Gloucester company above mentioned, has carried out some very interesting experiments upon the land of Mr. R. Bomford, near Evesham, while other trials have been made at nurseries at Bitton, near Bristol. The application of electric discharge has been divided into two groups of experiments, the first being conducted in the open, and the second upon plants under glass. At Evesham an area of some 20 acres has been subjected to electric action. The network of charged conductors is carried by about 20 poles, a series of thin wires being stretched between a pair of parallel thick wires; each of these pairs is borne by insulators raised about 16 ft. above the ground by means of larch poles. These wherever possible are placed near the hedge, although some are in the open field. Unfortunately, it is impracticable to show the network satisfactorily by photographs, as the wires are too fine to be seen. Owing to the high tension employed and the danger of excessive leakage in wet weather, special attention is paid to the insulation. The insulators used are of a special high-tension type, and prevent leakage down the pole, and interposed between the actual charged conducting wires and the insulator on the pole is a short length of wire terminating in another

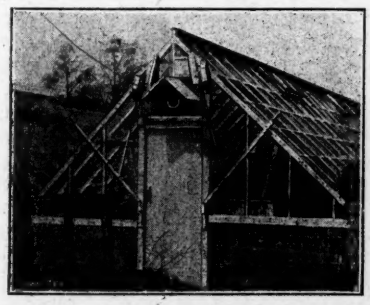


FIG. 2.

FIG. 3.

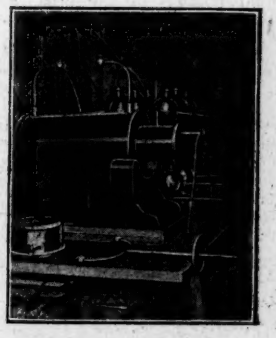


FIG. 4.

insulator, which in its turn carries the charged conductor. These conductors are made of comparatively large cross section so as to diminish leakage in the air, while the network over the area to be operated upon is composed of smaller wires. Mr. Priestley has found that in some cases it is advisable to place at intervals on these wires, twists or barbs pointing downwards, the points of the barb acting as a sort of jet for the electric "spray" to be directed towards the growth beneath. This does not appear to be so advisable when very high voltages are used. Fig. 4 shows a view of the induction coil or transformer of the Lodge valve used at Evesham, while fig. 3 illustrates the exterior of the transformer shed, showing the high-tension insulator leading the wire from the inside of the shed to the

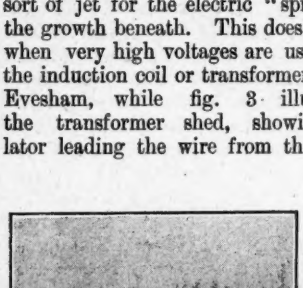


FIG. 5.

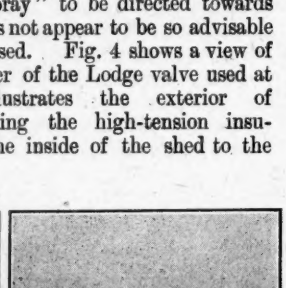


FIG. 6.

fields. It will be noticed that the insulator is protected as far as possible by a pent-house cover from the weather. As an example of the stimulating effect which the electric discharge has on the plant growth, figs. 5 and 6 may be compared to the boy shown. The first shows a growth in an electrified portion of the area, while the second shows a similar growth which is not under the treatment of electric discharges. If current is not available from a power house in the neighbourhood, a most convenient method of obtaining power is to use a small oil engine and dynamo set giving from 100 to 500 watts, with a voltage of from 10 to 250. The low-tension current should then be led to a transformer shed of water-tight construction placed as nearly as possible in the centre of the area to be treated, in order to diminish the chances of leakage from the high-tension conductors as far as possible. The strength of the discharge is tested at the induction coil by measuring the distance over which the spark will leap by means of the sparking arrangement shown lying on the table in fig. 4. In the field it is possible to test the discharge which is occurring by means of an insulated exploring wire held near to the ground which, on being touched with the finger, will give a slight shock when the high-tension wires, 10 ft. to 16 ft. overhead, are charged with high potential. At night the same effect can be tested by means of a vacuum tube placed in connection with the insulated wire.

In the experiments on plants under glass, the generating plant used at Bitton was of the influence machine type, while at Evesham the high-tension system used in the fields was extended to the green-houses. In this case the wires are attached to the door, which opens outwards, in such a way that it is impossible to open a door until the wire inside the green-house has been slackened and lowered to the ground, so as to earth it and prevent the person entering from receiving an electrical shock. If the door is closed again by the person entering, the wire is lifted again from the ground, and put under pressure, and he has to be careful of this fact. Fig. 2 shows the method of leading high-tension conductors into the green-houses. Under a pent-house roof is a porous cylinder, within which is a silica tube. Through this tube passes a wire which is insulated with india-rubber. Inside the house this wire is hooked on to another wire of small diameter running the length of the house, and supported by ebonite insulators fixed on either door by lengths of paraffined string running through holes in an ebonite rod. As the houses are arranged in groups of five, without partition walls between them, the charged wire is conducted from house to house under the wooden roof frames through a long cylinder of porous earthenware slung from the roof by paraffined string. At Bitton the risk of shock to the men working in the glass houses is avoided by running the discharge only at night, as a general rule, while if the discharge has to be run in the day, earthing arrangements, as described above, may be adopted.

It is impossible in a short article of this description to enter fully into the actual extent to which the results justify the treatment. As regards green-house work, Mr. Priestley is of the opinion that electrical treatment is more useful in the cases of crops grown in pots all over the floor of a large house, than for vines, cucumbers, &c., which climb up the sides of the house. The discharge does not appear to be very effective behind hot-water pipes and wire put up to support plants in green-houses. In the fields it appears that it is not desirable to apply electric discharge in very dry weather, as the crops yielded are decreased, while during rain the overhead wires leak too much, and therefore the treatment yields its best results when the weather is fine, and the soil contains enough moisture. Under these conditions the crop is accelerated, which acceleration may produce an increased crop by allowing the plants to mature and produce under the best conditions as to season. Moreover, acceleration means an early arrival of the produce on the market, which, of course, is of money value. For actual data regarding the results obtained on the various crops, it would be advisable to refer the reader to the two papers by Mr. Priestley, mentioned above, but sufficient has been said in this article to show that a comparatively new and very interesting field of experiment has been opened up for electricians who have sufficient knowledge of agriculture to operate under favourable conditions, and with a clear knowledge of the natural causes tending to produce good results. There appears to be no reason to doubt that within the next few years very remarkable developments will be seen in the application of electric discharges to agriculture. Possibly such developments will be more noticeable in regions such as the Canadian wheat areas, where large-scale farming is well understood, and where also supplies of current from centralised sources are freely available. There is, however, every reason to hope that even in Great Britain some attempt will be made on a larger scale even than at Evesham towards the development of this application, which, if successful, should prove of the greatest benefit to the agricultural community. The time has hardly yet arrived, however, when one may freely enter into the field with certainty that financial prosperity will, as a matter of course, follow from the application of electric discharges. Much more experiment and research must be effected before the conditions are fully known, but sufficient has already been done to make it evident that careful and painstaking work will not go without its due reward.

London County Council Coal Supply.—The Highways Committee reported at Tuesday's L.C.C. meeting that in view of the possibility of a difficulty arising with regard to the supply of coal for use at the Greenwich generating station, it had asked the Stores and Contracts Committee to make arrangements for the supply at an early date of a quantity of coal over and above the quantity which would be supplied during the next few weeks under the current coal contracts for the generating station, and in accordance with this request, a purchase of 4,500 tons had been made.

Fatal Accident.—An inquiry relative to the death of Alexander Macdonald, plumber, St. Mary's Terrace, East Wemyss, which took place at the Fife electric power station on December 14th last, was held at Cupar Sheriff Court last week before Sheriff Armour and a jury. It was stated in evidence that while Macdonald was on his way to procure some tallow for the purposes of his occupation at the power station, he had gone near a cable which was being tested and had touched it with the palm of his hand, death from electric shock resulting. Mr. Newlands, H.M. Inspector of Factories, said that, although there had been no violation of the regulations, he thought it was a case where the jury might add a rider to their verdict that there should be a screen or guard erected while such work was in progress. In accordance with this expression the jury added to their formal verdict the following rider: "The jury would suggest that in all cases of testing or general work where permanent fencing or safeguarding is impracticable, the danger zone should be screened off and a warning placard erected."

THE EARTH FAULT.

BY A. T. BULLEN.

EARTH faults frequently develop on electric circuits, as many of us know only too well, and some faults are hard to locate, and difficult to clear, as a large number of us also know. Other faults, although not really difficult to locate and clear, are tricky in their action, and often misleading.

Some earth faults again are very serious, while others which appear very similar on the face, have a practically negligible effect. As an illustration of this, two faults on the wound rotors of two induction motors on the same supply circuit may be cited. In the first case it necessitated the rewinding of the rotor, while in the second case the motor appeared none the worse for the defect.

Perhaps the most serious earth fault is the one that is registered by the consumer's meter. These faults are exceedingly unpopular. On one occasion a certain consumer had a very faulty installation, in fact, the current was leaking to earth in three separate places, and the result at the end of one quarter was astounding. Naturally the meter was disputed, but it was tested and found to be correct. The "dead earths" on the installation were, however, revealed, and the consumer had to pay. To say that he was indignant is putting it very mildly.

The most curious effect of an earth fault which it has been my privilege to witness, was on a certain D.C. circuit which supplied a butcher's shop. At the back of the shop was kept a brine tub which was slightly leaky, or else the brine had been carelessly handled, with the result that after a time some of it trickled through the floor, and came in contact with the electric wires. Electrolysis must have taken place, and metallic sodium was deposited, which, coming in contact with some water, caused an explosion and almost a fire. I feel satisfied that the explosion was not a short-circuit on the wires, since the fuses, which were of proper gauge, were afterwards all found to be intact.

The mains department of a certain supply company were misled recently by an earth fault which occurred on one of their own services. The supply taken was for two poly-phase induction motors, and an earth was traced from the sub-station to the yard in which these motors were working. One of the jointers called in at the yard to inspect the installation armed with a lamp and lead, which seems to be the jointer's usual method of testing. On tapping across from the main switch on one phase of the motor to the lead cover of the cable with his lamp, he obtained a full glow, and immediately jumped to the conclusion that the "earth" was on the motor. Instructions were given for the dismantling and cleaning of the motor, which certainly was in a very dirty condition. This done, an insulation test was taken on the motor and wiring, and being found to be of sufficient insulation resistance, the circuit was reconnected.

A day or so later the jointer, still tapping with his lamp in the sub-station, again obtained a full glow, which apparently meant a dead earth on the inner, and this he traced to the motor as before. The mains superintendent now visited the yard armed with a megger, and found that the motor and installation were in an excellent condition. He then tapped with his lamp from the company's cut-out (the fuses having been drawn) to the lead cover, and a dull glow showed—decidedly a partial earth on the service cable. Next the motor was reconnected and started, and the tapping again taken when the dull glow became a full glow.

The fuses on the other phase were next withdrawn, leaving the one phase only in circuit, and the glow once more dropped to half, thus showing that the additional voltage had been supplied from the opposite phase by a transformer action in the motor, and that the earth fault which existed was on the service only, and not half so serious as it appeared.

Had it been possible to open the switches on each circuit separately instead of them being coupled together, it is more than likely that much of the trouble caused by this partial earth would have been avoided. It was also curious, and perhaps misleading, that the earth voltage, together with the assistance it received from the motor, should just bring the lamp up to a full glow.

Before leaving the lamp and lead, it is worth while noting the older practice of permanently connecting a lamp between outer and earth. On one occasion where this had been done, a transformer failed and a large excess of voltage occurred across the lamp, smashing it and the holder completely. After that the other lamps were removed, and have not since been replaced.

An earth fault that occurs on an installation fitted with an auto-transformer is sometimes a very serious matter, and often ends very disastrously for the installation, since under certain conditions it is possible to get the full supply voltage across the lamps, which are often for use on circuits of about one-quarter the voltage. Such a case occurred some time ago at one of our public libraries, although, fortunately, only about 30 lamps suffered.

Earth faults sometimes assist electricians, as in the case of a motor which, although wrongly connected, was enabled to run simply because the installation was earthed in two places; but, generally speaking, they are things to be avoided.

They are often productive of very unpleasant shocks. The writer was once in a test room, the floor of which was of some patent material which reminded him of compressed red lead. Moreover, the installation was earthed on one pole. In making an adjustment to a meter he did not take the precaution of pulling out the switch, with the result that he was knocked backwards on to the floor. On that floor even the telephone could produce an unpleasant shock.

Speaking of meters calls to mind the inquisitive gentleman who was determined to know all about his electric meter, and therefore descended into the cellar with a candle, but, unfortunately, that meter was "earthed to case," and the gentleman found out more about the meter than he wanted to know.

The testing of meters for insulation is often carried out by flashing them with a considerable voltage from the coils to the frame, but this has been attended on more than one occasion with disaster. In one of our largest test rooms one of the assistants had his face blackened through flashing an earthed meter with about 600 volts and trying to see the effect too closely.

In a public convenience where lead-covered wires were used, an earth fault once developed, and the walls—which were quite damp—produced livid blue sparks at every point where contact was made with the lead. Needless to say, the attendant in charge became exceedingly alarmed.

Nearly all of the instances cited above serve to show how necessary it is to avoid earth faults on wiring, and contractors should do their utmost to assist in preventing accidents, which are often due to carelessness on their part.

Many contractors have great faith in the maxim, "Out of sight, out of mind," as is evidenced by the unprotected wires which we so often find under floors, and the flexible cords which have been run through disused gas pipes, simply because they go in easily.

Accidents, of course, are not always preventable, as is shown by the following case. Here the wires had been run in steel tubing under the floor, but some person other than an electrician had got to work with nail and hammer, pierced the tubing and found the wire. Great was his surprise to see the lamp above him suddenly burst into a most dazzling light, although the switch had not been touched, and then as suddenly break and go out. This was, of course, a circuit with an auto-transformer. It is worth noting that even stout steel tubing, if laid in contact with the floor boards, can readily be pierced in this way with a nail.

Although no blame can be put on electricians for such happenings as these, they are to blame for many similar accidents, and we cannot but hope that at least those who happen to read these lines will be more careful with hidden wires, and remember that the exposure of bad workmanship—and such exposures are bound to come—will not assist them in earning their daily bread.

Patent Restoration.—The *London Gazette* announces that an order was made on January 16th restoring No. 13,746, of 1903 (Samuel Marsh Young), for an invention entitled, "Improved method for operating signals on electric railways."

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"V. L. P." writes:—"I remember a case some time ago in which action was brought by a municipality against a private concern supplying electrical energy, and the case was successfully fought, I believe, under Sec. 23 of the Electric Light Act, 1909. I have looked up all my back numbers of the REVIEW in which I thought the case was reported, but I have not been able to find the information, and I shall be much obliged if you can enlighten me on the matter."

*** There is an excellent reason why "V. L. P." did not find the case referred to, namely, that there is no such case. Sec. 23 of the Electric Lighting Act, 1909, provides that where a supply is given in any area by authorised undertakers, no other local authority, company or person, may "commence to supply or to distribute electricity within the same area, unless such supply or distribution is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts, provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electric energy to consumers. Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking, other than the conveyance of public traffic." The Act which contains the above provision only came into operation in April, 1910, and there has been no case which involved the point raised.

No case could well have been decided favourably to a local authority prior to that date, in view of the fact that before the Act in question no restriction was placed on the supply of electricity by private persons in any part of the country.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

546. "Electrical ignition plugs for use in internal-combustion engines." G. CLARK. January 8th.

582. "Incandescent electric lampholders." J. FARLEY. January 8th. (Complete.)

588. "Telephone relay." P. DRESLA. January 8th. (Complete.)

627. "Systems of electric distribution." BRITISH THOMSON-HOUSTON Co., LTD., and A. P. YOUNG. January 8th.

628. "Electric indicating instruments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 8th.

643. "Method of regulating the current in direct-current arc lighting, searchlights, electric welding and the like." A. MARTIN, H. JACKSON, A. J. CAMPBELL, T. B. CAMPBELL and W. CAMPBELL. January 9th.

687. "Telephone systems." W. H. DERRIMAN. (Automatic Electric Co., United States.) January 9th. (Complete.

719. "Starting switches for use with electric motors and like purposes." C. W. ATKINSON. January 9th.

720. "Electrical train equipment." P. H. DAWE. January 9th.

722. "Electric clocks." BRITISH THOMSON-HOUSTON Co., LTD., and F. HOLDEN. January 9th.

723. "Electrically-heated stoves." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 9th.

725. "Apparatus for the electro-osmose method." GES. FUR ELEKTRO-OSMOSE m.b.H. (Convention date, October 2nd, 1911, Germany.) January 9th. (Complete.)

728. "Manufacture of electric accumulator electrodes." R. PAPE. (Divided application on 12,019/11, May 18th.) January 9th.

741. "Means for increasing the power factor and overload capacity of alternating-current asynchronous machines." G. KAPP. January 10th.

743. "Magnetic brakes of tramcars and like vehicles." G. J. CONATY and C. B. KETLEY. January 10th.

750. "Electric lampholders or the like." G. St. J. DAY. January 10th.

757. "Speed regulation of electrically-driven turning machines, such as lathes, boring machines and the like." F. GREENHALGH. January 10th.

771. "Electrolysis of metals." N. V. HYBINETTE. (Convention date, January 12th, 1911, Germany.) January 10th. (Complete.)

777. "Electrical apparatus for transmitting and receiving signals." SIR A. T. DAWSON and G. T. BUCKHAM. January 10th.

778. "Radio-disinfector." A. E. GOODGER and P. O. GRIFFITHS. January 10th.

804. "Stabilising voltaic arcs." C. E. GUYE. (Convention date, January 10th, 1911, Switzerland.) January 10th. (Complete.)

816. "Wheel for rail-borne vehicles, especially applicable to electric tramcars." A. H. MAYES. January 10th.

819. "Construction of electric storage batteries of the solid type." J. T. NIBLETT. January 10th.

828. "Electrical accumulators." W. BANNISTER. January 11th.

878. "Mounting filaments for incandescent electric lamps." DEUTSCHE GASGLUHLICHT AKT.-GES. (Auerges.) (Convention date, August 12th, 1911, Germany.) January 11th. (Complete.)

874. "Manufacture of electric incandescent lamps." DEUTSCHE GASGLUHLICHT AKT.-GES. (Auerges.) (Convention date, May 11th, 1911, Germany.) January 11th. (Complete.)

881. "Telephone receivers." SOC. WOLFF MANOURY ET CIE. (Convention date, February 9th, 1911, France.) January 11th. (Complete.)

900. "Means for retaining in position the shades of incandescent electric lamps." J. FARLEY. January 11th. (Complete.)

905. "Electric switches." M. GREENWALD. January 11th.

910. "Alternating-current electric motors." A. C. BELL. January 11th. (Complete.)

925. "Miners' electric safety lamp." G. LEACH. January 12th.

939. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. T. DOWDELL. January 12th.

953. "Electric arc lamps." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) January 12th. (Complete.)

956. "Apparatus for controlling motion from a distance, applicable more particularly to the control of searchlights or projectors, steering-gear and the like." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, September 28th, 1911, Germany.) January 12th. (Complete.)

957. "Alkaline electric accumulators." W. K.-L. DICKSON. January 12th. (Complete.)

976. "Holders and shades of incandescent electric lamps." J. FARLEY. January 12th. (Complete.)

986. "Holophane or other reflector shade carriers for electric lamps or the like." D. L. J. BROADBENT. January 12th.

991. "Incandescent electric lamps." F. BOUSSIN and J. AUGER. January 12th. (Complete.)

998. "Electric current regulators." J. KNIGHT. January 12th.

1,001. "Electrolytic manufacture of alloys of light metals with heavier metals and the continuous treatment of such alloys for obtaining final products and apparatus therefor." E. A. ASHCROFT. January 12th.

1,003. "Electrolytic manufacture of light metals and reaction products thereof, and apparatus therefor." E. A. ASHCROFT. January 12th.

1,004. "Electrolytic manufacture of caustic alkalies in pure anhydrous condition, and apparatus therefor." E. A. ASHCROFT. January 12th.

1,010. "System of metering electrical energy with special tariffs." LANDIS AND GYR. (Convention date, August 19th, 1911, Switzerland). January 12th. (Complete.)

1,013. "Miners' electric safety lamps." H. HUNTE and A. HUNTE. January 13th.

1,039. "Automatic electric winding mechanism for clockwork." SOC. ANON. DES HORLOGES ELECTRIC SILENTIA. (Convention date, March 10th, 1911, France.) January 13th. (Complete.)

1,079. "Electric measuring instruments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 13th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

ELECTRIC HEATING APPARATUS. H. F. Berry. 21,665. September 17th.

ELECTRIC CURRENT REGULATING AND CONTROLLING APPARATUS, SUCH AS ELECTRIC MOTOR STARTING AND CONTROLLING APPARATUS AND THE LIKE. J. A. Hirst and P. S. Brook. 29,889. December 17th.

EDDY-CURRENT ABSORPTION BRAKES. J. G. P. Thomas. 29,784. December 22nd.

ELECTRIC SUPERVISORY SYSTEMS FOR SPRINKLER FIRE-PROTECTION SYSTEMS. F. J. Brougham. (Dominion Guarantee Co.) 30,024. December 24th.

1911.

ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 6,095. March 10th.

PORTABLE TELEPHONES. W. Fairweather. (S. Stein.) 6,345. March 14th.

APPARATUS FOR TREATING LIQUIDS WITH ULTRA-VIOLET RAYS. V. Henri, A. Helbronner and M. von Recklinghausen. 8,157 and 8,158. March 3rd. (Divided application on No. 12,948 of 1910, December 23rd.)

TELEPHONE TRANSMITTERS. K. M. Turner. 8,932. April 11th.

TROLLEY WHEELS FOR ELECTRICALLY-DRIVEN VEHICLES. L. Pintner. 10,038. April 25th. (August 4th, 1910.)

ELECTRIC FURNACES. Rochling'sche Eisen und Stahlwerke Ges. and W. Rodenhauser. 10,231. April 27th. (December 13th, 1910.)

SPARK-GAP DEVICES FOR WIRELESS TELEGRAPHIC AND TELEPHONIC APPARATUS. E. Bellini and A. Tosi. 10,266. April 27th.

INSULATORS FOR HIGH-TENSION ELECTRICITY CONDUCTORS. F. Clouth, Rheinische Gummi-warenfabrik. 13,676. June 5th. (Addition to No. 1,009 of 1910.)

METHOD OF AND APPARATUS FOR REGENERATING BURNT-OUT CARBON AND METAL-FILAMENT ELECTRIC LAMPS. S. Bloch. 16,280. July 13th.

METHOD OF APPLYING A METALLISING LIQUID TO ELECTROTYPING MOULDS AND APPARATUS THEREFOR. H. S. Levy. 16,689. July 20th. (February 11th, 1911.)

DRUM-TYPE CONTROLLERS FOR THE SHUNT CONTROL OF ELECTRIC MOTORS. Allen, West & Co. and R. Moggridge. 16,870. July 21st.

ELECTRIC PUSH-BUTTON SWITCH. W. Brunner. 18,778. August 20th.

FURNACES FOR THE PRODUCTION OF METALLIC SODIUM BY ELECTROLYSIS. Scheitlin. 18,804. August 20th.

ELECTRIC HORNS. N. Lucas and S. Edwards. 19,084. August 24th.

MEANS FOR AUTOMATICALLY CONTROLLING HEAT IN ELECTRIC HEATING APPARATUS. J. Nightingall. 19,942. September 7th.

ELECTRICAL WELDING MACHINES. British Insulated and Helsby Cables, Ltd., and P. Bucher. 21,912. October 5th. (Divided application on No. 26,478 of 1910, November 15th.)

MEANS FOR USE IN AUTOMATICALLY CONTROLLING THE TIMING IN "MAGNETO" IGNITION APPARATUS. H. Diehl. 24,697. November 6th. (November 26th, 1910.)

Aquadag and Oildag.—Thanks to the courtesy of Mr. W. H. Allen, engineer and manager of the Loughborough Corporation Electricity Works, we are now enabled to state that the English agents for the Acheson graphite products are the Cromil Co., Milburn House, Newcastle-on-Tyne, to whom our numerous inquirers on this subject are referred.

Lamp-Selling.—As a part of their "Wotan" lamp business-extension campaign, MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, on Friday last, published a page advertisement of these lamps in the *Daily Express*. Copies of the advertisement were sent to trade customers for display on their premises.